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REPORT ON THE COMPREHENSIVE SURVEY OF THE WATER RESOURCES OF TH--ETC(U)  
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U.S. ARMY ENGINEER DISTRICT PHILADELPHIA  
U.S. ARMY ENGINEER DIV. • NORTH ATLANTIC

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# DELAWARE RIVER BASIN REPORT

DEC. 1960

## VOL. II

APPENDIX A. HISTORY OF INVESTIGATION

APPENDIX B. ECONOMIC BASE SURVEY

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REPORT ON THE  
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WATER RESOURCES  
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DELAWARE RIVER BASIN.

Volume II.

APPENDIX A and B.

HISTORY OF INVESTIGATION

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PREPARED BY  
U. S. ARMY ENGINEER DISTRICT, PHILADELPHIA  
CORPS OF ENGINEERS  
PHILADELPHIA, PA.  
JUNE 1960

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REPORT ON THE COMPREHENSIVE SURVEY  
OF THE  
WATER RESOURCES OF THE DELAWARE RIVER BASIN

APPENDIX A - HISTORY OF INVESTIGATION

I INTRODUCTION

1. This appendix contains a chronological history of the investigations and reviews made as a part of the comprehensive survey of the water resources of the Delaware River basin and the preparation of the report thereon. It has been subdivided into four parts as follows:

- I Introduction
- II Early Study Period, 1950-1955
- III Formative Period of Investigation 1955-1956
- IV Study and Review Period 1956-1960

Each of these parts is treated separately although there is some overlapping of occurrences listed chronologically in each. Authorizing resolutions, directives from higher authority, procedural plan of survey, summaries of public hearings and of major reports by other agencies, as well as other documents of particular significance, are included as exhibits to this appendix to provide for ready reference to these important collateral items.

II CHRONOLOGICAL HISTORY -  
EARLY STUDY PERIOD - 1950-1955

2. This chronological summary of the principal events leading up to this comprehensive investigation, and during its progress is included to show the sequence in which various important phases of the investigation were undertaken and completed. Many minor events occurred that contributed also to the success of the undertaking but have been omitted due to need for brevity. Those that follow are believed to present a fair picture of the progress of this investigation. The Early Study Period includes the time interval from the adoption of the first resolution requesting the study on 13 April 1950 by the Committee on Public Works of the United States Senate, to the great flood of 18 August 1955. The following major events occurred during this period.

a. 13 April 1950. The Committee on Public Works, United States Senate, adopted the first of the several resolutions that authorized this investigation. This resolution requested the Board



of Engineers for Rivers and Harbors to review the so-called "308 report" for Delaware River contained in House Document 179, 73d Congress, 2d Session, as well as reports supplemental thereto. The object of the review was to determine whether any modifications in the recommendations of the "308" report were advisable at the time of the review. The full text of this resolution is shown in EXHIBIT A of this appendix.

b. 19 July 1950. A public hearing was held in Philadelphia, Pennsylvania, by the District Engineer, U. S. Army Engineer District, Philadelphia, to determine the views and desires of local interests in regard to the recommendations in House Document No. 179, 73d Congress, 2d Session. A digest of the hearing proceedings is contained in EXHIBIT B of this appendix.

c. 11 September 1950. The Interstate Commission on the Delaware River Basin (INCodel) adopted a report entitled "Utilization of the Waters of the Delaware River Basin" at its annual meeting. The report was prepared by Malcolm Pirnie, Engineers, New York City, and Albright & Friel, Inc., Philadelphia, which had been retained by the Commission to make an investigation of the Delaware River basin and a study on equitable distribution of its waters. On the basis of that report, a summary of which is contained in EXHIBIT C, INCodel recommended that a basin water commission be established, by the four states concerned, with powers to plan, finance, construct and operate the recommended integrated water project, and that it be authorized to sell water service capacity and to receive supporting funds from the states.

d. 2 June 1951. The State of Delaware adopted an act to establish a Delaware River Basin Water Commission contingent upon the States of New Jersey and New York and the Commonwealth of Pennsylvania passing substantially similar acts.

e. 25 June 1951. The New Jersey legislature passed an act "substantially similar" to that of Delaware contains a proviso that it would not become effective until the State of New York and the Commonwealth of Pennsylvania had passed similar acts.

f. June 1951. The Governor of Pennsylvania appointed a Pennsylvania Water Resources Committee to study the report on "Utilization of the Waters of the Delaware River Basin," adopted on 11 September 1950 by the Interstate Commission on the Delaware River Basin. This committee was headed by Albert M. Greenfield, as chairman, and included eight leading citizens of the Delaware Valley area.

g. 15 August 1952. The Governor of New York approved an act to establish the Delaware River Basin Water Commission.

h. 6 February 1953. The Pennsylvania Water Resources Committee submitted its report to the Governor and recommended that Pennsylvania not become a party to the INCODEL Plan, but that it cooperate with New Jersey in the construction of Wallpack Bend Reservoir when the need for additional upland water supplies arises. The Committee also outlined a plan for development of the water resources of that portion of the Delaware River watershed lying in Pennsylvania. A summary of that report is contained in EXHIBIT C. No action was taken on the Committee's report, except that a bill introduced in the Pennsylvania House of Representatives on 11 May 1953 to accept the INCODEL Plan was not passed. The INCODEL Plan, therefore, could not be implemented by the other three States under the terms of their enacted legislation.

i. 30 December 1953. The New Jersey Legislature passed Bill No. 383, which permits Pennsylvania to construct Wallpack Bend Dam on Delaware River without further New Jersey legislative action. It also permits New Jersey to participate up to 30 percent in the cost of this project and to receive 30 percent of the water stored in and released from this reservoir.

j. 7 June 1954. The United States Supreme Court accepted the report of the Special Master and issued an amended decree covering the diversion of water from the Delaware River watershed for New York City water supply. This decree authorizes New York City to divert 800 million gallons of water per day from the watershed after completion of its water supply plan. It sets up special provisions for releases of water during low-flow periods and the controls for making these releases. It also permits the State of New Jersey to divert 100 million gallons per day from the watershed without compensating storage. After compensating storage has been provided by New Jersey in the Delaware River watershed, that State may divert additional amounts of water except in July, August, September and October of any year when diversion will still be limited to 100 million gallons per day. This amended decree is shown in EXHIBIT D.

k. January 1955. The New Jersey Assembly, by Joint Resolution No. 4, created the Legislative Commission on Water Supply of the State of New Jersey for the purpose of studying the water resources of the State and recommending to the Legislature steps that should be taken to ensure an adequate water supply for the immediate and more distant future. On 3 May 1955 the Commission engaged the firm of Tippetts-Abbott-McCarthy-Stratton, Engineers, of New York City, to investigate and prepare a report on the development of New Jersey's water resources. This firm presented its preliminary report on 15 July and its final report on 31 December 1955. A summary of the portions of that report pertaining to the Delaware River basin is contained in EXHIBIT C.

l. 25 May 1955. The Department of Forests and Waters of Pennsylvania secured the services of Albright & Friel, Inc., to review the Wallpack Bend project as proposed in the 1950 INCODEL Plan, and to prepare an estimate of cost to reflect 1955 prices. The report, dated 1 September 1955, was submitted to the Pennsylvania Department of Forests and Waters and contained an estimated cost of about \$70,450,000 for this project. A summary of that report is contained in EXHIBIT C.

m. 30 June 1955. The Governor of Pennsylvania signed Act No. 69 which authorizes Pennsylvania to construct the Wallpack Bend Reservoir with New Jersey participating in accordance with provisions of New Jersey Bill No. 383 approved 30 December 1953.

n. 7 July 1955. A tentative report of preliminary examination scope prepared by the District Engineer, U. S. Army Engineer District, Philadelphia, pursuant to the resolution adopted 13 April 1950 was forwarded by the Division Engineer, U. S. Army Engineer Division, North Atlantic, to the Chief of Engineers.

o. 19 July 1955. The Governor of Pennsylvania sent letters to the Governors of New Jersey, New York and Delaware, and to the Mayors of Philadelphia and New York City proposing that a commission be formed, composed of representatives of the four states and the two cities, to undertake a joint survey of the water resource problems of the Delaware River basin.

### III CHRONOLOGICAL HISTORY - FORMATIVE PERIOD OF INVESTIGATION - 1955-1956

3. In July 1955 the Governors and Mayors agreed to form such a commission composed of one appointee named by each of them. However, before such an agency could be formed, disaster struck the Delaware River basin. This came in the form of hurricane "Diane" that struck the valley on 18 August 1955 and the ensuing flood that lasted essentially two days. "Diane" had been preceded about a week earlier by another hurricane, called "Connie", that had produced copious rainfall over most of the Delaware watershed. However, "Connie" occurred at the end of a minor drought period, and while it saturated the surface of the basin, no appreciable floods resulted. Before the basin could dry out, hurricane "Diane" struck. Very heavy floods resulted, particularly in the Pocono Mountains area. These floods claimed 100 lives and caused damage estimated in excess of \$100,000,000 in the Delaware basin.

4. Prompt action was taken for relief operations in the Delaware River basin. On 20 August 1955 the President of the United States declared the regions affected by floods caused by "Diane" to be major disaster areas. He directed that the Federal Civil Defense



Administration initiate emergency flood relief measures immediately. On 23 August the Corps of Engineers was designated to serve as engineers for the Federal Civil Defense Administration and the relief work was designated "Operation Noah." Emergency operations were in progress for several weeks and the emergency costs resulting from this flood were about six and a quarter million dollars. The occurrence of this flood marked the end of the early study period described above, and the beginning of a new period in this investigation in which the water resources situation in the Delaware River basin was reviewed and plans were formulated for the investigations and studies required for the preparation of a comprehensive plan and report on the basin's water resources.

a. 22 August 1955. The Chief of Engineers returned to the Division Engineer the tentative report of preliminary examination scope, forwarded on 7 July 1955, for reconsideration in view of the recent floods.

b. 14 September 1955. The Senate Public Works Committee also reacted to this disaster in the Delaware River basin, and on this date adopted the first of several resolutions calling for new investigations and further review of prior reports. This resolution, which is contained in EXHIBIT A, requested the Board of Engineers for Rivers and Harbors to review previous reports on the Delaware River, covering the area affected by the hurricane flood of August 1955, to determine the need for modification of prior recommendations and the advisability of adopting further improvements for flood control and allied purposes.

c. 14 October 1955. Steps were taken to survey the damage and compile a field estimate of the damage caused by the August flood. To make the required damage survey a contract was negotiated and signed on this date, with a consulting engineer firm to do this work. The date of completion of the contract was fixed as 31 December 1955.

d. 14 November 1955. A third resolution was adopted by the Senate Committee on Public Works on this date. This resolution requested that a review of previous reports be made to determine the feasibility of flood protective measures in the New York area of the Delaware River watershed. This resolution is contained in EXHIBIT A.

e. December 1955. The Governors of Delaware, New York, New Jersey and Pennsylvania, and the Mayors of Philadelphia and New York City selected representatives to form the Delaware River Basin Survey Commission, as suggested earlier by the Governor of Pennsylvania. In the meantime, the effects of the August 1955 flood had resulted in the Senate Committee on Public Works requesting the Board of Engineers for Rivers and Harbors to make a survey of the water resources of the Delaware River basin, similar to that contemplated

by the Governors and Mayors. This development required the revising of the objectives of the Delaware River Basin Survey Commission. This was done at the first meeting of this Commission in March 1956.

f. January 1956. Four public hearings were held during this month by the District Engineer, U. S. Army Engineer District, Philadelphia, to determine the views and desires of local interests with respect to the control and development of the water resources in the basin, as a result of the great flood of August 1955. These hearings also provided an opportunity for local interests to present additional data showing the extent of the flood damage to major flooded areas and their views of the flood protection needed in these areas. These hearings were held as follows:

Port Jervis, New York	6 January 1956
Stroudsburg, Pennsylvania	13 January 1956
Trenton, New Jersey	20 January 1956
Philadelphia, Pennsylvania	27 January 1956

Transcripts of the proceedings at these hearings are on file in the office of the U. S. Army Engineer District, Philadelphia, and digests of the transcripts are contained in EXHIBIT B.

g. 14 February 1956. The President approved the "Urgent Deficiency Appropriation for FY-1956", Public Law No. 406 appropriating \$31,000 for the comprehensive survey and \$55,000 for Northeast Flood Studies.

h. 20 February 1956. The Senate Committee on Public Works adopted a fourth resolution affecting the investigation. This resolution requested the Board of Engineers for Rivers and Harbors to determine the feasibility of constructing and operating a reservoir on the main stem of the Delaware River above Delaware Water Gap near Wallpack Bend, or Tocks Island, on a cooperative basis by the United States, the Commonwealth of Pennsylvania and the State of New Jersey as a part of a comprehensive plan to develop and utilize the water resources of the Delaware River basin. This resolution is contained in EXHIBIT A.

i. 13 March 1956. A conference was held in New York City by the U. S. Army Engineer District, Philadelphia, with representatives of the Federal agencies having interests in water resources studies. The purpose of the investigation was explained and their cooperation and assistance were solicited.

j. 24 March 1956. A meeting of the representatives appointed to the Delaware River Basin Survey Commission was held. This conference reviewed the situation regarding a survey for the Delaware River basin and the actions taken by the Public Works Committee of the Senate in authorizing it. The representatives recommended that the name of the Commission be changed to the Delaware River Basin Advisory Com-

mittee and that its objectives be changed to make it an advisory committee to the Governors and the Mayors and to cooperate with the Corps of Engineers in the authorized investigation.

k. 2 April 1956. The U. S. Army Engineer District completed a Preliminary Procedural Plan for survey of the Delaware River Basin Water Resources. On 10 April 1956 copies of this plan were sent to each cooperating agency with the request that it investigate the completeness of data on hand or available; determine specifically the extent of field investigations it would require; make a plan for its cooperation; and estimate the funds it would require to perform the cooperative effort outlined in the procedural plan. The plan, as finally adopted, is contained in EXHIBIT E.

l. 20 April 1956. The Commonwealth of Pennsylvania conducted a public hearing in Stroudsburg, Pennsylvania, to obtain the views of local interests on the proposal to build Wallpack Bend Dam and Reservoir. The U. S. Army Engineer District, Philadelphia, was represented and presented its views at this hearing. Later, the Commonwealth began the purchase of land in the reservoir area with funds provided from State taxes.

m. 14 May 1956. The Chief of Engineers directed the U.S. Army Engineer District, Philadelphia, to prepare a review report of survey scope on the Delaware and tributaries and to include therein a survey of the engineering and economic aspects of flood control, water supply, low-flow regulation, hydroelectric power, and allied uses of water.

n. 13 June 1956. The House of Representatives Public Works Committee adopted Resolution No. 640 requesting that the review of previous reports on Delaware River include the determination of the feasibility of providing flood protective measures in the New York area of the watershed. (This resolution is almost identical to that adopted by the Senate Committee on Public Works on 14 November 1955). This Committee also adopted Resolution No. 643 on the same date. This second resolution requested that a determination be made as to what improvements were advisable for flood control and allied purposes in the Counties of Northampton and Monroe, Pennsylvania, and the City of Easton, Pennsylvania. These resolutions are contained in EXHIBIT A.

o. 2 July 1956. Delaware River Basin Research, Incorporated, was founded by private interests. It was sponsored initially by the Delaware River Basin Advisory Committee. The purpose of this non-profit corporation is to sponsor research and make available information about water resources for dissemination to the public. The corporation received a grant of \$131,000 from the Ford Foundation on 25 March 1957 and placed a contract with Syracuse University Research Institute,



Syracuse, New York, on 17 April 1957 for analysis of the legal, fiscal, and governmental organization involved in water resources development on an interstate stream, with special emphasis on the Delaware River. The name of this organization was changed to Water Research Foundation on 23 June 1959.

p. 2 July 1956. Approval of the appropriation for FY-1957, Public Law No. 641, was given by the President, appropriating \$500,000 for the comprehensive investigation and \$100,000 for Northeast Flood Studies.

q. August 1956. The Governors of Delaware, New York, New Jersey and Pennsylvania, and the Mayors of Philadelphia and New York City issued a joint directive to their representatives. This directive officially constituted the Delaware River Basin Advisory Committee and outlined its duties and responsibilities. This directive is contained in EXHIBIT F.

r. 30 August 1956. The Commonwealth of Pennsylvania conducted a public hearing in Easton, Pennsylvania, to secure the views of local interests on the flood protection for that city. The U. S. Army Engineer District, Philadelphia, was represented and presented its views at this hearing.

s. 11 September 1956. The position of the Corps of Engineers in carrying out the assignment of the survey of the water resources of the Delaware River, was outlined by the Secretary of the Army in a letter to the Undersecretary of the Department of the Interior. This position was stated "as being mainly that of a coordinator in the development of a plan which will encompass many functions and activities not within this Department's sphere of authority. In fact, it is probable that a major part of the plan will be carried out by non-Federal interests, or by Federal agencies other than the Corps." A copy of this letter is contained in EXHIBIT G.

t. 22 October 1956. The President of the United States sent a directive to the Secretary of the Army, and a copy to the Department level of each of the agencies participating in the Delaware River investigation. This letter stated that every effort must be made to utilize the technical resources of the Federal agencies and those of the state and local governments in the assembly and evaluation of data pertinent to the comprehensive survey. This letter also suggested that the Corps of Engineers invite representatives of the Federal agencies and the non-Federal public instrumentalities to participate in coordinating committees or advisory groups. It stated that the President believed it would be advisable for such groups to hold regular meetings to review progress and discuss problems of general interest. The Delaware River Survey Coordinating Committee was organized and has held regular meetings as proposed by this letter, a copy of which is in EXHIBIT G.

u. 23 October 1956. The Commonwealth of Pennsylvania conducted a hearing in Easton, Pennsylvania, to obtain the views of local representatives on proposals for a reservoir project at either Wallpack Bend or Tocks Island. The U. S. Army Engineer District, Philadelphia, was represented and its views were presented.

y. 8 November 1956. The final draft of the "Procedural Plan for the Survey of the Delaware River Water Resources" was distributed to all interested agencies and comments were solicited. EXHIBIT E contains the plan of survey, as adopted 25 March 1957.

w. 21 December 1956. An Augmented Plan of Survey was prepared by the U. S. Army Engineer District, Philadelphia, and submitted to the Chief of Engineers for approval. This plan outlined the various phases of the investigation as well as the portions of it to be carried out by the cooperating agencies. It included the "Procedural Plan of Survey".

#### IV CHRONOLOGICAL HISTORY - STUDY AND REVIEW PERIOD - 1957-1960

5. The preceding period set the stage for the various reviews and studies required for this investigation. The procedural plan and the plan of survey outlined these investigations and indicated those to be undertaken by the various cooperating agencies. During the preceding period, numerous conferences with the various agencies established the general scope of the cooperative studies, their estimated cost and the extent of the agency reports to be submitted. It was also decided that these agency reports would be included as appendices to the comprehensive report. This fourth period was devoted to the making of these investigations, the selection of the comprehensive plan, and the preparation and review of the reports covering the various studies.

a. 12 January 1957. The Assistant Secretary of the Army requested the Secretaries of Interior; Agriculture; Commerce; Labor; and Health, Education and Welfare; and the Chairman of the Federal Power Commission to designate representatives to serve on a Delaware Basin Survey Coordinating Committee. The Governors of Delaware, New Jersey, New York and Pennsylvania, and the Mayors of Philadelphia and New York City were also asked to name representatives to this Committee. The request advised each of them that the District Engineer, U. S. Engineer District, Philadelphia, would represent the Department of the Army and would serve as permanent chairman of the Committee. EXHIBIT G contains a copy of this letter.

b. 6 February 1957. An accelerated study of the feasibility of constructing a dam at the Tocks Island site on Delaware River was completed at the request of the Pennsylvania Joint Committee to Study and Examine Various Plans Developed for the Distribution of Water from the Delaware River. The results were furnished the Committee and the Governors of Pennsylvania and New Jersey, and made public. The report on the study is contained in EXHIBIT H.

c. 1 April 1957. The U. S. Army Engineer District, Philadelphia, issued a Data Book. This book contained a collection of basic data for which there appeared to be a common need among the several agencies cooperating on this investigation. It presented a brief history of the survey; a number of source documents; a detailed discussion of the studies assigned the several agencies; and the general plan and schedule adopted for this investigation. It also contained a limited amount of basic physical data as well as suggestions for the format and general composition of the report and appendices.

d. 2-3 April 1957. The first meeting of the Delaware Basin Survey Coordinating Committee was held in the Marlborough-Blenheim Hotel, Atlantic City, New Jersey, with an attendance of 88 persons. Colonel Allen F. Clark, Jr., District Engineer, U. S. Army Engineer District, Philadelphia, became its first chairman. The Chairman introduced the "Quaker way" of conducting committee meetings which was adopted by the Committee. (Under this method the chairman acts as "Clerk of the Meeting." He listens to the discussion of each particular point, and at the time when it seems to him that the committee has begun to reach an agreement, he summarizes each point and so states it as the "sense of the meeting." Then if there are no objections it stands as the decision of the committee. If it is challenged and there can be no unanimity, the chairman suspends the subject for the time being to permit more careful consideration and the gathering of more facts relating to the subject.) The "Procedural Plan for the Survey" and the Data Book were introduced and discussed. Status-of-work reports were presented by the several Federal agencies and statements by the representatives of the four States and the two Cities. Minutes of this meeting are contained in EXHIBIT I.

e. 15-16 August 1957. The second meeting of the Delaware Basin Survey Coordinating Committee was held at Lehigh University, Bethlehem, Pennsylvania, with 110 persons in attendance. Status-of-work reports and statements were presented, by the various members of the Committee, and discussed. Eight technical papers, each relating to a difference phase of the investigation, were presented by members of the agency staffs and briefly discussed. These papers were reproduced as appendices to the minutes of the meeting and are on file in the office of the U. S. Army Engineer District, Philadelphia. Minutes of the meeting, exclusive of these technical papers are included in EXHIBIT I.



f. 26 August 1957. Appropriation of FY-1958, Public Law No. 167, was signed by the President, authorizing an additional \$500,000 for the investigation during fiscal year 1958.

g. 5 September 1957. The U. S. Public Health Service, Department of Health, Education and Welfare, submitted a "Summary Report on Insects of Public Health Importance in the Delaware Basin" as a part of the cooperation of this agency in the comprehensive water resources investigation. This report provides information on the present status of insect-borne diseases and insect vectors and their control; a determination of the influence that water resources development may have upon insect problems; and recommendations for safeguarding the public health. The final draft constitutes Appendix L of this survey report.

h. 7-8 November 1957. A conference on "The Monetary Appraisals of the Effects of Multi-Purpose Projects" was held in the District Office, Corps of Engineers, Philadelphia. Participants were representatives of the Corps of Engineers and the other Federal agencies participating in the survey.

i. 14-15 November 1957. The third meeting of the Delaware Basin Survey Coordinating Committee was held in Nemours Auditorium, Wilmington, Delaware, with 117 persons in attendance. Colonel W. F. Powers, newly appointed District Engineer, U. S. Army Engineer District, Philadelphia, succeeded Colonel Allen F. Clark, Jr., as chairman of the Committee. Status reports and statements were presented, by the various members of the Committee, and discussed. Two technical papers were also presented and discussed briefly. These papers were reproduced as appendices to the minutes of the meeting and are on file in the office of the U. S. Army Engineer District, Philadelphia. Minutes of this meeting, exclusive of the technical papers, are included in EXHIBIT I.

j. 27 February 1958. The U. S. Department of Agriculture submitted the draft of the first of several portions of its report on a study of the agricultural resources of the Delaware River basin as a part of its cooperation in the comprehensive investigation. Drafts of other portions of the report were submitted on 6 May and 6 October 1958 and 4 June and 19 October 1959. The report presented statistical data and descriptive material on agriculture in the area and a study of trends in land use, livestock numbers and farm management practices. It takes into account the effect of past changes and provides certain guides to probable future adjustments in agriculture. The full report prepared by the Department of Agriculture constitutes Appendix K to this survey report.



k. 27-28 February 1958. The fourth meeting of the Delaware Basin Survey Coordinating Committee was held in the Edison Building auditorium, Philadelphia. Status reports and statements were presented, by the various Committee members, and discussed. Four technical papers dealing with various phases of flood studies and estimates of water requirements were presented, by staff members of the U. S. Army Engineer District, Philadelphia, and were briefly discussed. These papers were reproduced as appendices to the minutes of the meeting and are on file in the office of the U. S. Army Engineer District, Philadelphia. The minutes of the meeting, exclusive of the technical papers, are included in EXHIBIT I.

l. 28 April 1958. The Senate Committee on Public Works adopted a resolution requesting that the review of previous reports, in conjunction with the comprehensive survey of the Delaware River, also consider the feasibility of constructing a barrier in the Delaware River estuary as well as the economic and physical effects of such a structure. This resolution is contained in EXHIBIT A.

m. 1 May 1958. The Office of Business Economics, U. S. Department of Commerce, submitted the first draft of its report on an economic base survey of the Delaware River Service Area, as a part of the cooperation of this agency in the comprehensive water resources investigation. This report measures in broad terms of output, income, employment and population the comparative growth of the United States and the Delaware River Service Area. It projects the trends in the growth of these economic factors to the years 1965, 1980 and 2010. The final draft constitutes Appendix B of this comprehensive survey report.

n. 9 May 1958. The National Park Service, Department of the Interior, submitted the first portion of the first draft of its report on the recreation resources of the Delaware River Service Area, as a part of the cooperation of this agency in the comprehensive water resources investigation. The second part of this draft was submitted 1 July 1959. This report was prepared to present basic background material relating to recreation resources; to provide a clear understanding of the geographic area considered; and to formulate a plan for the utilization of the area's recreation resources. The final draft constitutes Appendix I to this comprehensive survey report.

o. 26-27 June 1958. The fifth meeting of the Delaware Basin Survey Coordinating Committee was held in the auditorium of the Honesdale High School, Honesdale, Pennsylvania, with 136 persons in attendance. Status reports and statements were presented and briefly discussed. Two technical papers were presented and discussed

and the tentative reports on ground water, recreation resources, and water quality were summarized and discussed. All of these reports and summaries were included as appendices to the minutes of the meeting and are on file in the office of the U. S. Army Engineer District, Philadelphia. Minutes of this meeting, exclusive of the appendices, are included in EXHIBIT I.

p. 27 June 1958. The Office of Business Economics submitted its final report on the economic base survey. It is contained in Appendix B to this comprehensive survey report.

q. 10 July 1958. The Governors of Pennsylvania, New Jersey and Delaware, the Mayor of New York City, and representatives of the Governor of New York and the Mayor of Philadelphia met at Washington Crossing, Pennsylvania, to receive reports of the progress of the Delaware basin survey and the Syracuse study.

r. 2 September 1958. Approval of the appropriation for FY-1959, Public Law 85-836, was given by the President. The sum of \$500,000 was appropriated for this comprehensive survey.

s. 18-19 September 1958. The sixth meeting of the Delaware Basin Survey Coordinating Committee was held at Hunter College, New York City, with 110 persons in attendance. Status reports and statements were presented and discussed. Seven technical papers were also presented and briefly discussed. These papers were included as appendices to the minutes of the meeting and are on file in the office of the U. S. Army Engineer District, Philadelphia. The minutes of the meeting, exclusive of the appendices, are contained in EXHIBIT I.

t. 23 September 1958. Basic data on sedimentation in the Delaware River basin were submitted by the U. S. Geological Survey as a part of the first draft of its report on ground water resources. Further consideration of the sedimentation characteristics of the basin resulted in the later assignment of this study jointly to the Geological Survey and the U. S. Soil Conservation Service. The results of this joint cooperative study constitute Appendix H to this survey report.

u. 23 September 1958. The U. S. Geological Survey submitted the first draft of its report on the general geology and ground water resources of the Delaware River basin as a part of the cooperation of this agency in the comprehensive water resources investigation. The report describes the character and evaluates the magnitude of the ground water resources, explains their physical and chemical variability in time and place, summarizes the uses of ground water, and describes the hydrologic factors that act to limit control and use of this source of water. The final draft constitutes Appendix N of this survey report.

v. 20 October 1958. A public hearing was held in the Nemours Auditorium, Wilmington, Delaware, by the District Engineer, U. S. Army Engineer District, Philadelphia. This hearing was held to obtain the views and desires of local interests with respect to a salt water barrier in the Delaware estuary, a study of which was requested by the Senate Committee on Public Works in the resolution adopted on 28 April 1958. The transcript of the proceedings at this hearing is on file in the office of the U. S. Army Engineer District, Philadelphia, and a digest of it is contained in EXHIBIT B.

w. 26 November 1958. The U. S. Department of Agriculture submitted the first draft of its report on the water demands for rural water use in the Delaware River basin and water-dependent areas outside the Delaware River watershed as a part of its cooperation in the comprehensive investigation. It included data on irrigation of crops and pasture, rural domestic water supplies, agricultural processing, spraying, milk cooling, washing of dairy equipment, cleaning of vegetables for markets, and water for livestock. The final draft constitutes Appendix G to this survey report.

x. 22-23 January 1959. The seventh meeting of the Delaware Basin Survey Coordinating Committee was held at the Academy of Natural Science, Philadelphia, with 122 persons in attendance. A brief on the Water Supply Act of 1958 was presented and discussed. Statements on the existing state policies on the compatible uses of multiple-purpose reservoirs were made by members of the Coordinating Committee from each of the four States. A statement on this subject by the representative of the U. S. Public Health Service dealt with the practices of the states and municipalities in the other areas of the United States outside the Delaware River basin. The District Engineer, U. S. Army Engineer District, Philadelphia, presented a paper outlining a tentative plan for the comprehensive development of the Delaware River basin's water resources. These summaries and technical papers were included as appendices to the minutes of this meeting and are on file in the office of the U. S. Army Engineer District, Philadelphia. The minutes of this meeting, exclusive of the appendices, are contained in EXHIBIT I.

y. 19 March 1959. The U. S. Public Health Service submitted the first part of the first draft of its report on water use and stream quality in the Delaware River basin, made as a part of its cooperation in the comprehensive water resources investigation. This section of the report presented an overall assessment of the present water requirements of the Delaware River Service Area for municipal and industrial water supply and some of the historical development of these supplies. These data were presented to provide a basis for the projections of future water demands necessary for the planning of resources development and the evaluation of the comprehensive plan of development selected. The final draft is part of Appendix C to this survey report.



z. 30 April 1959. The U. S. Army Engineer District, Philadelphia, completed the first draft of a report presenting hydrologic data and their sources for the Delaware River basin, and an analysis of these data with regard to the formulation of a comprehensive plan for the development of the water resources of the basin. The final draft constitutes Appendix M of this survey report.

aa. 13-14 May 1959. The eighth meeting of the Delaware Basin Survey Coordinating Committee was held at Split Rock Lodge, Lake Harmony, Pennsylvania, with 131 persons in attendance. The Chairman was Lieutenant Colonel Frank A. Gerig, Jr., Acting District Engineer, U. S. Army Engineer District, Philadelphia, due to the retirement from service of Colonel W. F. Powers, former Chairman. Status reports and statements were presented and discussed. Nine technical papers were presented and briefly discussed. A brief report was presented on the progress of the study of the organizational structure to be proposed for the control and development of water resources of the Delaware River basin. These papers and report were included as appendices to the minutes of the meeting and are on file in the office of the U. S. Army Engineer District, Philadelphia. The minutes of the meeting, exclusive of the appendices, are included in EXHIBIT I.

ab. 10 July 1959. The U. S. Geological Survey submitted its final report on ground water resources and general geology. The report constitutes Appendix N to this survey report.

ac. 11 August 1959. The Federal Power Commission submitted the first draft of a report on power markets and valuation of power as part of its cooperation in the comprehensive water resources investigation. The report contained data showing past and estimated future electric power requirements of the Delaware River Service Area, the magnitude and characteristics of the markets which could absorb the output of potential hydroelectric projects on the Delaware River and its tributaries, and the power values or benefits associated with power installations at these projects. The final draft constitutes Appendix F to this survey report.

ad. 13 August 1959. The U. S. Army Engineer District, Philadelphia, completed the first draft of a report presenting data on flood conditions in the Delaware River basin. The report describes areas flooded, types of flood damage, extent of damage resulting from the August 1955 flood, and the methods developed to determine average annual flood damage, as well as the benefits to be expected from potential flood control measures. The final draft constitutes Appendix D to this survey report.

ae. 1 September 1959. Syracuse University Research Institute completed its study of governmental administration of water resources in the basin. The report discusses the problems of finance, law and administrative structure involved in water resources development, and recommends the establishment of a basin agency to administer these resources. The Syracuse study was presented to the Board of Directors of the Water Research Foundation on 10 September 1959, and released to the public on 21 September 1959.

af. 4 September 1959. The U. S. Department of Agriculture submitted its final report on irrigation and rural water use. It constitutes Appendix G to this survey report.

ag. 4 September 1959. The U. S. Army Engineer District, Philadelphia, completed the first draft of a report presenting data relating to existing and approved navigation projects on the Delaware River and its tributaries. The report also presented commercial statistics showing port and terminal facilities and the tonnage carried annually on these waterways. The final draft constitutes Appendix E to this survey report.

ah. 9 September 1959. The State of Delaware submitted a report covering a survey of the water resources of that State. It contains basic data on water resources and needs in Delaware. The report constitutes Appendix O to this comprehensive survey report.

ai. 10 September 1959. The U. S. Public Health Service submitted the second part of the first draft of its report on water use and stream quality in the Delaware River basin made as a part of its cooperation in the comprehensive water resources investigation. This portion of the report describes past and present water quality conditions, and projects these conditions to 1980. The final draft is included in Appendix C of this survey report.

aj. 10 September 1959. Public Law No. 85-254 was signed by the President, authorizing an additional \$322,000 for the investigation during fiscal year 1960.

ak. 21 September 1959. A brief report on the study of the governmental organization for the development and control of the water resources of the basin, prepared by the Water Research Foundation for the Delaware River basin, was received by the District Engineer. The brief report is Appendix X to this survey report.

al. 30 September 1959. The Governors of Pennsylvania and New Jersey, the Mayors of New York City and Philadelphia, and the representatives of the Governors of Delaware and New York, met in Philadelphia to review the status of the Delaware basin survey and to consider the recommendations of the Syracuse report. A joint

directive was subsequently issued by the four Governors and two Mayors which recognized the need for a unified water resources agency for the Delaware, and instructed the Delaware River Basin Advisory Committee to prepare a proposed draft of legislation to create such a basin agency by interstate-Federal compact.

am. 6 October 1959. The Geological Survey and the Soil Conservation Service submitted their final joint report on sedimentation in the Delaware River basin. It constitutes Appendix H to this survey report.

an. 9 October 1959. The ninth meeting of the Delaware Basin Survey Coordinating Committee was held at the Stacy-Trent Hotel, Trenton, New Jersey, with 118 persons in attendance. The status of the comprehensive report and the general details of the tentative comprehensive plan were discussed. Methods for determining the effect of the 7 June 1954 amended decree of the United States Supreme Court were explained and discussed. Requirements for local assurance of cooperation on potential projects were explained to the group. Colonel T. H. Setliffe, District Engineer, became the new chairman of the Committee, Minutes of this meeting are included in Exhibit I of this appendix.

ao. 3 December 1959. The U. S. Army Engineer District, Philadelphia, completed work on a partial draft of this appendix. Chronological coverage was completed to the preceding entry and the draft was distributed to other agencies for review and comment on 9 December 1959.

ap. 4 December 1959. The Fish & Wildlife Service submitted the initial draft of its report on fish and wildlife resources. The final draft constitutes Appendix J to this survey report.

aq. 8 December 1959. The U. S. Army Engineer District, Philadelphia, completed its first draft of a report presenting the results of a study of gross and net water needs. The final draft constitutes Appendix P to this survey report.

ar. 16 December 1959. The U. S. Army Engineer District, Philadelphia, completed the initial draft of the report on its study of the feasibility of constructing a salt water barrier in the Delaware River estuary. The final draft constitutes Appendix S of this survey report.

as. 17 December 1959. The Office of Business Economics transmitted to the District Engineer revised material for updating its report on the Economic Base Survey. The revised material is included in Appendix B of this survey report.

at. 22 December 1959. The National Park Service submitted its final draft of the report on recreation resources, which constitutes Appendix I to this survey report.

au. 28 December 1959. The Public Health Service furnished additional material for revision of its report on Insects of Public Health Importance, which is Appendix L to this survey report.

av. 29 December 1959. The Federal Power Commission submitted the final draft of its report on Power Markets and Valuation of Power, which is Appendix F to this survey report.

aw. 15 January 1960. The Public Health Service furnished the initial draft of additional material for Appendix C.

ax. 28 January 1960. The Department of Agriculture submitted a portion of the final draft of its report on Agriculture in the Delaware Basin, which is Appendix K to this survey report.

ay. 3 February 1960. The U. S. Army Engineer District, Philadelphia, completed its final draft of the report presenting data on flood conditions which constitutes Appendix D to the survey report.

az. 8 March 1960. The work group composed of representatives of the National Park Service Regional Office, Region No. 5, and the U. S. Army Engineer District Office, Philadelphia, completed its initial draft of a report on Recreation Needs and Appraisals, which is Appendix W to this survey report.

ba. 9 March 1960. The U. S. Army Engineer District, Philadelphia, completed its final draft of the report on navigation, Appendix E of this survey.

bb. 25 March 1960. The Department of Agriculture submitted the last portion of its final draft of the report on agriculture in the basin which is Appendix K to this survey report.

bc. 29 March 1960. The initial draft of Appendix U, containing descriptions of the projects and cost estimates, was completed by the U. S. Army Engineer District, Philadelphia.

bd. 31 March 1960. The tenth meeting of the Delaware Basin Survey Coordinating Committee was held at Madison Hotel, Atlantic City, New Jersey. The principal items of business were the presentation of the status of the comprehensive report and a presentation and discussion of material to be presented at the four public hearings scheduled for April and May.



be. 1 April 1960. The joint work group composed of representatives of the U. S. Army Engineer District, Philadelphia, and the Engineering and Watershed Planning Unit of the Soil Conservation Service, Upper Darby, Pa., completed the initial draft of a report on the planning of water control at intermediate upstream levels. The final draft on this subject is Appendix R to this survey report.

bf. 4 April 1960. The Fish and Wildlife Service submitted its final draft of the report on fish and wildlife resources which appears as Appendix J to this survey report.

bg. 11 April 1960. The U. S. Army Engineer District, Philadelphia, completed the initial draft of the report on the formation of the plan of development. The final draft is Appendix Q to this survey report.

bh. April-May 1960. Four public hearings were held by the District Engineer for the purpose of discussing the plan of improvement. The hearings were held as follows:

Phillipsburg, New Jersey	13 April 1960
Reading, Pennsylvania	20 April 1960
Wilmington, Delaware	27 April 1960
Port Jervis, New York	4 May 1960

The District Engineer outlined the various elements of the plan under consideration, and all present were given an opportunity to express their views concerning the need, advisability, character and extent of the plan. Digests of the records of these hearings are contained in Exhibit I of this appendix.

bi. 26 April 1960. The U. S. Army Engineer District, Philadelphia, completed the initial draft of the first five chapters of the main report on this comprehensive survey.

bj. 11 May 1960. The U. S. Army Engineer District, Philadelphia, completed the initial draft on its study of the feasibility of hydroelectric developments. The final draft constitutes Appendix T of this survey report.

bk. 12 May 1960. The final draft of Appendix P to this report dealing with water needs was completed by the U. S. Army Engineer District, Philadelphia.

bl. 13 May 1960. By letter of this date the Regional Office of the Fish and Wildlife Service, Boston, Mass. informed the District Engineer, Philadelphia, that the results of the study of the effects that regulated flows might have on salinity distribution

in the bay were such that their applicability to the comprehensive survey effort were limited. The study of the regulated flows on bay conditions was made by the Chesapeake Bay Institute for the Fish and Wildlife Service, with the intent that the Service would have a biological interpretation made of those results. This investigation was undertaken in accordance with the proposal made by the Fish and Wildlife Service in its letter of 3 December 1957.

bm. 16 May 1960. The U. S. Army Engineer District, Philadelphia, completed the initial draft of the report on its study of benefits and cost allocations. The final draft is Appendix V to this survey report. The District also completed its final draft of Appendix S, the report on the study of the feasibility of constructing a salt water barrier in the Delaware River estuary.

bn. 18 May 1960. The U. S. Army Engineer District, Philadelphia, completed the final draft of the report on its hydrologic studies which is Appendix M to this survey report.

bo. 23 May 1960. The Public Health Service submitted the last increment of material for the final report on its study of water use and stream quality. That report is Appendix C to this survey report. The U. S. Army Engineer District, Philadelphia, and the National Park Service completed the final draft of their report on recreation needs and appraisals which is Appendix W to this survey report.

bp. 27 May 1960. The U. S. Army Engineer District, Philadelphia, completed the initial draft of the last five chapters of the report on this comprehensive survey.

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The chronology is terminated at this point in order that this appendix may be prepared for reproduction. The work remaining to be accomplished consists of making such revisions as may be necessary to put the main report and Appendices A, Q, R, T, U, and V in final form.

APPENDIX A  
HISTORY OF INVESTIGATION

EXHIBIT A  
AUTHORIZING CONGRESSIONAL RESOLUTIONS

## APPENDIX A - HISTORY OF INVESTIGATION

### EXHIBIT A

#### AUTHORIZING CONGRESSIONAL RESOLUTIONS

The Board of Engineers for Rivers and Harbors was requested to review prior reports on investigations in the Delaware River basin in connection with a comprehensive survey of its water resources with a view to determining the need for modification of prior recommendations contained therein and preparing of a comprehensive plan for development of the basin's water resources. Requests for the review are contained in the following resolutions adopted by the United States Senate, or the House of Representatives, Public Works Committees:

- a. **RESOLVED BY THE COMMITTEE ON PUBLIC WORKS OF THE UNITED STATES SENATE**, That the Board of Engineers for Rivers and Harbors, created under Section 3 of the River and Harbor Act, approved June 13, 1902, be, and is hereby, requested to review the report on the Delaware River contained in House Document Numbered 179, Seventy-third Congress, Second Session, and reports supplementary thereto, with a view to determining whether any modifications in the recommendations contained therein are advisable at this time. Adopted: April 13, 1950.
- b. **RESOLVED BY THE COMMITTEE ON PUBLIC WORKS OF THE UNITED STATES SENATE**, That the Board of Engineers for Rivers and Harbors, created under Section 3 of the River and Harbor Act, approved June 13, 1902, be, and is hereby, requested to review previous reports on the Merrimack River, Massachusetts and New Hampshire; Blackstone River, Massachusetts and Rhode Island; Thames River, Massachusetts and Connecticut; Connecticut River, Connecticut, Massachusetts, Vermont and New Hampshire; Housatonic River, Connecticut, Massachusetts and New York; Delaware River, New York, New Jersey and Pennsylvania; Susquehanna River, Pennsylvania and New York; Potomac River, Virginia, Maryland, West Virginia and District of Columbia; and intervening streams; in the area affected by the hurricane flood of August 1955, to determine the need for modification of the recommendations in such previous reports and the advisability of adopting further improvements for flood



control and allied purposes in view of the heavy damages and loss of life caused by such floods. Adopted: September 14, 1955.

- c. RESOLVED BY THE COMMITTEE ON PUBLIC WORKS OF THE UNITED STATES SENATE, That the Board of Engineers for Rivers and Harbors, created under Section 3 of the River and Harbor Act, approved June 13, 1902, be, and is hereby, requested to review the report on the Delaware River, New York, New Jersey, and Pennsylvania, contained in House Document Numbered 179, Seventy-Third Congress, Second Session, and other reports, with a view to determining the feasibility of providing flood protective measures in the New York area of the watershed. Adopted: November 14, 1955.
- d. RESOLVED BY THE COMMITTEE ON PUBLIC WORKS OF THE UNITED STATES SENATE, That the Board of Engineers for Rivers and Harbors, created under Section 3 of the River and Harbor Act, approved June 13, 1902, be, and is hereby, requested to review the report of the Chief of Engineers on the Delaware River, N. Y., N. J., and Pa., contained in House Document Numbered 179, Seventy-third Congress, Second Session, and other reports, in connection with the pending comprehensive survey of said stream with a view to determining the feasibility of construction and operation of a reservoir on the Main Stem of the Delaware River above Delaware Water Gap near Wallpack Bend or Tocks Island, on a cooperative basis by the United States and the Commonwealth of Pennsylvania and the State of New Jersey, as an integral unit of a comprehensive plan for the control and utilization of the water resources of the Delaware River in the interest of flood control, navigation, water supply, stream pollution abatement, recreation, control of the movement of salt water, electric power, and other purposes. Adopted: February 20, 1956.
- e. RESOLVED BY THE COMMITTEE ON PUBLIC WORKS OF THE HOUSE OF REPRESENTATIVES, UNITED STATES, That the Board of Engineers for Rivers and Harbors be, and is hereby, requested to review the reports on the Delaware River contained in House Document No. 179, 73rd Congress, 2nd Session, with a view to determining the feasibility of providing flood protective measures in the New York area of the watershed. Adopted: June 13, 1956.
- f. RESOLVED BY THE COMMITTEE ON PUBLIC WORKS OF THE HOUSE OF REPRESENTATIVES, UNITED STATES, That the Board of Engineers for Rivers and Harbors be, and is hereby, requested to review the reports on the Delaware River and its tributaries, Pennsylvania, New Jersey and New York, published as House Document 179, 73rd Congress, and appropriate reports with a view to determining whether improvements in the interest of flood

control and allied purposes are advisable at this time, particularly in the counties of Northampton and Monroe and the city of Easton, Pennsylvania. Adopted: June 13, 1956.

- g. RESOLVED BY THE COMMITTEE ON PUBLIC WORKS OF THE UNITED STATES SENATE, That the Board of Engineers for Rivers and Harbors, created under Section 3 of the River and Harbor Act, approved June 13, 1902, be, and is hereby, requested to review the reports of the Chief of Engineers on the Delaware River, New York, New Jersey, and Pennsylvania, contained in House Document Numbered 179, Seventy-third Congress, Second Session, and other reports, in conjunction with the pending comprehensive survey of said stream, with a view to determining the feasibility of construction of a barrier in the Delaware estuary, such study to consider the economic and physical effects of such a structure, the costs and potential benefits of the structure, and the economic and physical relationship of such a structure to other works of improvement now being planned for the Delaware River Basin. Adopted: April 28, 1958.

APPENDIX A  
HISTORY OF INVESTIGATION

EXHIBIT B  
PUBLIC HEARING DIGESTS



# EXHIBIT B

## PUBLIC HEARING DIGESTS

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## APPENDIX A - HISTORY OF INVESTIGATION

### EXHIBIT B - PUBLIC HEARING DIGESTS

#### I - INTRODUCTION

1. a. Six public hearings were held by the U. S. Army Engineer District, Philadelphia, in the early stages of the survey to secure the views and desires of various interests, organizations, and individuals in the objectives of this investigation. The specific dates and locations at which these hearings were held are indicated in the digest of the records for each of them. The first of them was held in 1950 as a result of the Senate Committee on Public Works resolution adopted 13 April 1950; four of them were held in 1956 as a result of similar resolutions adopted after the August 1955 flood in Delaware River; and the sixth hearing was held in 1958 to obtain the views and desires of local interests regarding a proposed barrier in the Delaware River estuary. Prior to each hearing approximately 200 invitations were extended to individual representatives of the various governmental agencies, civic groups and other interested parties. All local radio broadcasting stations and newspapers were furnished notices of the hearings and all local postmasters were requested to post a copy of these notices in a conspicuous place in their establishments. Attendance at these hearings varied from about 50 persons to about 150 and was considered to have been representative of the interests which would be affected by the river basin developments under consideration. Several agencies and other interests, which did not send representatives to the hearings, submitted written statements explaining their interests and desires for various improvements. These were made a part of the record of these hearings. Verbatim records were taken at each hearing by court reporters and official transcripts were prepared of the records of these hearings. These transcripts are on file at the U. S. Army Engineer District, Philadelphia, Pa., and digests prepared from them are included herein.

b. Four additional hearings were held in the Spring of 1960, during the final stages of the survey and preparation of the report, in strategic locations in the basin to present the principal results of the studies and to obtain the views of various interests regarding the proposed plan of development. Prior to these hearings approximately 2,000 invitations were extended in each case to interested parties. This number included local radio stations, newspapers and postmasters. Attendance at these four hearings varied from about 100 to 300 persons and was considered to be representative of the interests affected. Verbatim records were taken at each hearing and official transcripts were prepared which are on file at the U.S. Army Engineer District, Philadelphia, Pa. Digests of the transcripts are included herein to cover the facts presented and views expressed.

II PUBLIC HEARING AT PHILADELPHIA, PENNSYLVANIA -  
19 JULY 1950

2. This hearing was held in response to the resolution adopted on 13 April 1950 by the United States Senate Committee on Public Works. An attendance of 48 persons at this hearing was believed to be representative of the interests of the Delaware River basin who would be affected by the development of the river that was contemplated by the above resolution. The facts presented and the views expressed at this hearing are summarized in the paragraphs which follows.

3. Mr. Francis A. Pitkin, Chairman, Interstate Commission on the Delaware River Basin (INCodel), presented oral and written statements in which he referred to the "308 report" submitted in 1932 and to the subsequent reviews made of this report. He outlined the establishment and activities of INCodel which culminated in the preparation by Malcolm Pirnie, and Albright & Friel, Inc., engineering consultants, in 1950 of a new plan for utilization of the waters of Delaware River. The report on this plan covered a basin-wide study of the possibilities for integrated improvements in the upper basin areas to provide storage so as to increase water yields for municipal water supply and stream flow regulation, and to permit incidental development of hydroelectric power. He cited the sponsoring by INCodel of the Senate Committee on Public Works resolution, adopted 13 April 1950, which initiated the review of House Document No. 179, 73d Congress, 2d Session (the "308 report"). He expressed the hope that the Corps of Engineers would give particular consideration to such prospective benefits as would serve to justify Federal participation in a project for conservation of the Delaware River's water resources. On interrogation by the District Engineer, U. S. Army Engineer District, Philadelphia, he stated that the plans formulated under the auspices of the Commission made no specific provision for any modification of the existing Corps of Engineer flood control projects on the Lehigh and Lackawaxen Rivers, to serve the interests of conservation and river regulation.

4. Mr. James H. Allen, Executive Secretary of INCodel, stated that he only desired to call attention to a letter he had received from U. S. Senator Robert C. Hendrickson of New Jersey, who had sponsored the Committee resolution of 13 April 1950. He stated that Senator Hendrickson expressed full support of the Commission's proposal, and regretted that he could not attend the hearing.

5. Mr. Francis S. Friel, President of Albright & Friel, Inc., Engineering Consultants, stated that he had no statement to make, but would be glad to be available to answer any questions regarding the report his firm had prepared for INCodel.

6. Mr. Robert A. Harrier, Managing Director, Lehigh Valley Flood Council, stated that the residents of the Lehigh Valley are extremely interested in the earliest possible construction of the flood control



dam (Bear Creek Dam) that has been authorized for the Lehigh River. He felt that the Council would be vigorously opposed to any development that might delay the construction or impair the effectiveness of this dam. He was granted permission to submit a later statement concerning the position of the Lehigh Valley Flood Control Council on improvements on Delaware River. Mr. J. C. Knowles, President, Lehigh Valley Flood Control Council, was present and concurred in Mr. Harrier's statement of the Council's position.

7. Mr. John A. Klett, Secretary and Counsel, Delaware River Development Corporation, stated that his corporation had applied to the Federal Power Commission for a preliminary permit (Project #2039) to enable it to make the examinations, surveys and explorations necessary to determine the feasibility of developing Tocks Island, Belvidere and Chestnut Hill sites on Delaware River for the production of hydroelectric power. This development would be in coordination with the plan proposed by INCODEL for developments to provide water supply and stream flow regulation. He stated that his primary interest in appearing at the hearing was to present evidence that would convince the Corps of Engineers that hydroelectric development on the Delaware River should be accomplished by private enterprise; that there is no precedent for interstate development of hydroelectric power; and that there are inherent difficulties that cannot be surmounted in that type of development by an interstate group. He stated further that the reservoir which his corporation proposes to construct at Tocks Island site, could be in operation within about 2-1/2 years after issuance of a license to his company, whereas the first stage of development as planned by INCODEL, all of which would be upstream, would require some 15 years for construction. He pointed out that the only deviation from the plan proposed by INCODEL would be the substitution of a dam at Tocks Island site for that proposed for construction at Wallpack Bend.

8. Mr. A. G. Hillberg, Consulting Engineer for Delaware River Development Corporation, explains the coordination of their plan for hydroelectric power development with that proposed by INCODEL. He stated that the upstream regulation proposed by INCODEL would increase the potential power at Tocks Island site by 20 percent. He reviewed the plans proposed by both groups and stated that the 50 percent greater capacity proposed for Tocks Island reservoir over that at Wallpack Bend would permit his corporation to guarantee a flow of 4,000 cubic feet per second at Trenton, New Jersey for 98 percent of the time. He discussed the effect of his proposed project on fish life, particularly on shad, and gave assurance that whenever successful means were developed for passing fish over dams his corporation would be glad to install such facilities at its dams on Delaware River. He compared steam-electric and hydroelectric power production and systems, and stated that his corporation proposed to sell its energy output wholesale to established electric systems in New Jersey and Pennsylvania for relief of their steam electric plants during peak load periods.

9. Mr. C. J. Reap and Mr. A. Emerson Howell, appeared as attorneys for the Wayne County (Pa.) Flood Control Committee, submitted a written statement and reviewed it orally at the hearing. They stated that the Committee had authorized them to protest vigorously any changes in the construction of Dyberry and Prompton flood control reservoirs on Dyberry Creek and Lackawaxen River, respectively, in Wayne County. They pointed out that the projects had been authorized after thorough study; that the areas they would protect are subject to recurring flooding that has caused loss of human life and millions of dollars of property damage; that to delay construction of these projects would be economically unsound and would be prejudicial to the security of the population of Wayne County; that while the conservation of water resources is essential, the authorized project should not be modified to solve problems unrelated to flood control. After being assured by INCODEL that its plan did not include modification of the flood control project, they indicated they had no further opposition to that plan.

10. State Senator Montgomery F. Cowl, Pennsylvania Member of INCODEL, stated that he lived in the Poconos and that he feared the dams proposed by the Delaware River Development Corporation would wipe out a great section of the Pocono resort region, which not only included resorts, but hunting, fishing, and wildlife, and everything else. He stated that he was opposed to anything of that kind, especially in the lower Delaware in the vicinity of Stroudsburg, Delaware Water Gap and Shawnee which would be affected by the Tocks Island project.

11. Letters, briefs, and memoranda were submitted by other interests, in connection with the hearing, and expressed views as follows:

a. The Bureau of Foreign and Domestic Commerce, U. S. Department of Commerce, through its Regional Office, Philadelphia, Pennsylvania, expressed interest in the hearing and offered to cooperate in the study by supplying data on economics of the area.

b. The Delaware River Joint Toll Bridge Commission (an agency of the States of Pennsylvania and New Jersey), protested the proposed construction of dams on Delaware River on the grounds that they would seriously affect existing and contemplated new bridges and that these dams might be used for bridges, or roadway purposes.

c. New Jersey Department of Conservation and Economic Development, Division of Water Policy and Supply, suggested that the INCODEL report be given due consideration by the Corps of Engineers so that no unnecessary duplication of work, or expenditure of public money, be made during this investigation and review. The Department stated that it was opposed to the applications made to the Federal Power Commission by private companies for the development of water power on the Delaware River by private interests. It stated that it felt that any further development of water power on this river should be secondary and incidental to the more important utilization of these waters for municipal and industrial water supply and stream regulation.

d. Atlantic States Marine Fisheries Commission, transmitted a memorandum prepared by the U. S. Fish and Wildlife Service, Department of the Interior. This memorandum had been prepared after a review of the preliminary INCODEL report dated January 1950. The memorandum recommended that (1) alternate plans be developed not calling for the construction of main-stem dams across the Delaware River; (2) if the construction of these main-stem dams is insisted upon, that they be provided with fishways which the Fish and Wildlife Service has found to be capable of passing shad over the dams; (3) in addition to fishways which will pass shad, that diversion channels built in connection with main-stem dams be screened to keep out young downstream-migrating shad.

e. The Joint Executive Committee for the Improvement and Development of the Philadelphia Port Area, in a letter, expressed "the confident belief that a further reduction in the runoff of water at Trenton by diversion, or by regulated control, under which the production of hydroelectric power and water supplies are the principal factors, would injuriously affect the tidal portion of the Delaware River below Trenton and cause irreparable damage to industry and commerce and consequently reduce the usefulness of improvements heretofore authorized for the benefit of navigation." This agency urged that thorough consideration be given to what it firmly believed to be a damaging effect on the commerce and industry of the Philadelphia Port.

f. The Greater Philadelphia-South Jersey Council, by letter, urged that particular attention be given in review of upstream projects to determine their effects on salinity intrusion in the estuary and that consideration be given to all plans that would result in a downstream retreat of salinity conditions.

III PUBLIC HEARING AT PORT JERVIS, NEW YORK  
6 JANUARY 1956

12. The major flood of August 1955 in the Delaware River resulted in the passage of additional resolutions by the Committees on Public Works in the United States Senate and House of Representatives. These requested additional reviews of prior recommendations for flood control and other developments as contained in prior reports. This hearing and the next three public hearings were held to secure data on conditions produced by the August 1955 flood and to obtain the views and desires of various agencies, organizations, and individuals on further development of the water resources of the Delaware River basin.

13. Mr. Horace Evans, New York State Flood Control Commission, Albany, New York, stated that that agency had developed a program estimated to represent a capital investment, both Federal and State, of some \$140,000,000. A number of studies are pending for additions to this program and the Review Report on the Delaware watershed is included. Mr. Evans expressed hope that information received at the hearing, and the ensuing investigation, would result in Corps of Engineers recommendations to the Congress for projects beneficial to people of the flood-stricken area. He stated that the Commission further hoped that the study would justify the undertaking of minor flood control projects without requiring Congressional authorization. Channel clearing, snag removal, and bank stabilization were cited as examples of minor flood control projects, and maximum Federal cost was cited as \$150,000. Speaking for the State of New York, Mr. Evans offered complete cooperation by that State in any projects the District Engineer might find justifiable, dependent upon action by the State Legislature. He pointed out that the Legislature has never failed to make an appropriation sufficient to carry out required participation in authorized projects recommended by the Corps of Engineers. Mr. Evans contributed copies of the New York flood control law which he stated had been considered as a model flood control law.

14. Assemblyman Wilson C. Van Duzen, Orange County, New York, gave assurance of all possible assistance to Mr. Evans to enable him to more fully cooperate in the suggestions of the U. S. Army Engineer District, Philadelphia.

15. Mr. John Boardman, representing the Interstate Commission on the Delaware River Basin (INCodel), stated that the services and facilities of that agency would be available to the Corps of Engineers in its study of Delaware River basin. He reviewed the January 1951 recommendation of INCODEL, that the States of New York, New Jersey and Pennsylvania create an interstate agency to construct and operate four reservoirs in the upper basin. He cited the opposition by Pennsylvania to this recommendation and discussed the unilateral construction of the Cannonsville Reservoir by the City of New York and how the consummation of INCODEL's plan would have eliminated a substantial part of the damage created in



New York State by Hurricane Diane in August 1955. He recommended that every effort be made to develop those units that would be located in the headwater region of the Delaware River as a part of the water resources plan.

16. Mr. James T. Murphy, Mayor of Port Jervis, New York. The Mayor cited estimated damages caused to Port Jervis by Hurricane Diane. He then cited the following existent flood hazards and his recommendations for their elimination:

a. Temporary dams have been formed by fallen trees, rock and debris in streams leading to the Delaware River. These give way when sufficient water pressure is built up behind them and cause sudden rises in the river. He recommended that such streams be kept clean to prevent this flood damage.

b. Silt deposits in the bed of the Neversink River at its junction with the Delaware have raised the bed of this river and have increased flooding in the Tri-State area. He recommended that dikes be constructed along the south bank of the Neversink and Delaware Rivers to provide protection for the Tri-State area.

c. The dike along the Delaware River at the upper end of Port Jervis is 50 years old and in need of rehabilitation. The banks and channel along this dike are overgrown with trees and underbrush which further raise flood levels. He recommended a survey of the area and the raising of the dike as high as practicable without endangering Matamoras, Pa.

17. Mr. James W. Anderson, Director of Jubilee Ranch, (a children's camp located near Godeffroy in the Neversink River valley), stated that the camp which houses an aggregate of 1,200 children over a 10-week period each summer, is now worthless due to the danger of being flooded. He requested every consideration be given to prevent future flooding of the camp. He proposed that the channel of the Neversink River be enlarged by dredging in this area.

18. Mr. Joseph Maxwell, a retired marine engineer, stated he lived across from Jubilee Ranch and witnessed the results of the flood. He stated that he has seen many floods in his 28 years of Navy service all over the world and acknowledged the benefits of the dredging done by the Corps of Engineers on the Hudson River. He recommended dredging the Neversink River channel to greater depths as the only practical solution to the problem.

19. Mr. John C. Thompson, Executive Engineer, New York State Water Power and Control Commission, expressed the opinion that the Corps of Engineers has been hampered in the past by estimating evaluation and relative cost only for flood control structures. He pointed out that consideration should also be given to the use of storage reservoirs and other types of multiple purpose developments for water resources in addition to developments for flood control alone.

20. Mrs. Edna M. Covart, Matamoras, Pennsylvania, stated that she has property in Matamoras directly opposite the junction of the Neversink River with the Delaware. She believed that the Delaware River should be dredged along the front of Matamoras, Pennsylvania, to reduce flooding at that point.

21. Mr. Henry Zehner, Tusten, New York, requested the District Engineer to include in the overall study a consideration of clearing and snagging in small tributary streams and in the channel of the Delaware River near Tusten, New York.

22. Mr. Merlin Strait, Supervisor, West Fall Township, Pike County, Pennsylvania, proposed that the islands in the Delaware River below Matamoras, Pennsylvania, should be cleared and the river dredged in this reach.

23. Mr. Fred Mason, Port Jervis, New York, pointed out the shoaling that has occurred in the Delaware River below the junction of the Neversink River. He also stated that the failure of small dams in the Neversink River increased flood heights in both streams. He proposed that New York State exercise greater control over safety of dams; that the levee at Port Jervis be raised; and that the channel in the Delaware River be enlarged by dredging and building up the banks.

24. Mrs. Lillian Barnum, Neversink Grove, near Godeffroy, New York, called attention to the bank erosion along the Neversink River in this area as well as the flooding caused by the Neversink River in the August 1955 flood. She suggested building a flood wall or dredging the river.

25. Mr. Leonard Krupp, Supervisor, Town of Rockland, Sullivan County, New York, requested by letter that some Government representatives visit that area to discuss a recommendation which the writer felt might be more economical, and a great deal more effective, than the Army Engineer plan, which was rejected in 1954 by higher authorities.

IV PUBLIC HEARING AT STROUDSBURG, PENNSYLVANIA  
13 JANUARY 1956

26. This was the second of the Public hearings held after the August 1955 flood. This one was held in one of the towns that suffered the greatest damage from this occurrence.

27. Honorable Francis C. Walter, Member of Congress, from Easton, Pennsylvania, announced that he expected that funds would be appropriated and the Lehigh Valley Flood Control Project started shortly. He stated that he felt that the water resources of the Delaware River basin should be developed, not alone for flood control, but for water supply and other allied purposes. He recommended to the people of the area that they organize themselves to promote development of the basin and that they insist that Pennsylvania enter into a compact with the States of New Jersey and New York for development and use of the water resources of the Delaware basin and then call upon every interested branch of the government to construct the desired improvements.

28. Mr. W. V. Iorns, Hydraulic Engineer, U. S. Geological Survey, pointed out the value of Pepacton and Neversink Reservoirs during the August 1955 flood. These reservoirs, although constructed entirely for water supply purposes, impounded the flood waters rising above those sites, and prevented greater flooding from occurring along the streams below them, and to some extent on the main stem of Delaware River and in the lower Neversink River at Port Jervis, New York.

29. Mr. Maurice K. Goddard, Secretary of the Pennsylvania Department of Forests and Waters, represented the Commonwealth of Pennsylvania. Mr. Goddard pointed out that Bear Creek reservoir on Lehigh River, Prompton and Dyberry reservoirs in the Lackawaxen River basin, as well as channel improvements at Allentown and Bethlehem had been authorized by Congress before the August 1955 flood but no funds were appropriated for any of them. He also pointed out that it was estimated that had these projects been completed and in operation, the damage created by that flood would have been reduced by at least \$20,000,000. He urged that all "push" for completion of the projects, for there was no doubt of their justification. He stated that many meteorologists now believe that the Atlantic hurricane path has definitely shifted, and that the East Coast may expect more and more storms of hurricane force in the future. He recommended that research be carried on in "cloud seeding", since one eminent scientist has suggested that the path of these hurricanes might thereby be controlled to some extent. With reference to flood plain zoning, Mr. Goddard stated that zoning privileges have been granted to civil subdivisions and it is the duty of local authorities alone to exercise them. Mr. Goddard outlined a program which he felt should be undertaken. He stated that every possible effort should be made to improve land use practices in the basin so as to control runoff at the source to the maximum degree possible. These efforts should

include continuation of conservation education; extension of soil conservation districts; full utilization of the provisions of Public Law 566 (The Watershed Protection and Flood Prevention Act); the organization of local watershed agencies, similar to the Brandywine Valley Association; and further use of "tree farms." He recognized, however, that improved land use is only part of the answer. He stated that we must also plan and construct flood control reservoirs and other protective works on tributary streams wherever they are found feasible. He recognized the limitations imposed by physical and cultural development on this phase of the program and stated that these localized flood prevention measures need to be supplemented by main stream structures. He called attention to previous reports of the Corps of Engineers, and to the INCODEL report on the utilization of the Delaware River water resources, as well as the prior studies of upland water sources made by the City of Philadelphia. He requested that careful consideration be given to potential development of the Wallpack Bend site on Delaware River, as well as the supplementary potentials at Belvidere and Tocks Island and at the other sites referred to in House Document No. 179, 73d Congress, 2d Session. He submitted a report dated 1 September 1955 on Wallpack Bend Dam and Reservoir that had been prepared by Albright & Friel, Inc., for the Department of Forests and Waters. He pointed out that the amended United States Supreme Court decree and reciprocal legislation enacted by both Pennsylvania and New Jersey make it legally possible for Pennsylvania to construct Wallpack Bend project with New Jersey participating up to 30 percent in both cost and water. He felt, however, that the need for flood control was so great that this project should be a joint undertaking by the Federal government and the two states. He stressed that there was a real need for the development and execution of a Delaware River basin program for effective control and utilization of water for municipal and industrial water supply, irrigation, drainage, pollution and salinity control, navigation, recreation, hydroelectric power, and allied purposes.

30. Mr. Francis A. Pitkin, Chairman of INCODEL, referred to existing Congressional resolutions requesting the review of previous reports and stated emphatically that INCODEL stands willing and ready to assist the Corps of Engineers to the fullest degree, in the re-examination of the problem of control and development of the water and related land resources of the Delaware River basin. He also stated that insofar as practicable the services and facilities of the Commission will be available at all times to the Corps of Engineers. He stated that the time had arrived for the preparation of a broad gauge, comprehensive multiple-purpose program for the development of the water resources of the Delaware River basin. He stated that this plan should encompass the entire watershed and should cover the control and utilization of the waters and related natural resources of the region for all purposes affecting the safety, health and general welfare of the people in the basin. Such purposes should include municipal and industrial water supply; farm use, including irrigation; abatement of floods, pollution, salinity and soil erosion; recreation; protection of oysters, fish and wildlife; produc-



tion of food and fiber; navigation; electric power; and other related purposes. He also stated that INCODEL is of the opinion that the authority, inherent in the Congressional resolutions of 13 April 1950 and 14 September 1955 requesting the review survey, is sufficiently broad to carry out this comprehensive study. He pointed out that INCODEL has a direct interest in such projects as the Cannonsville Reservoir on West Branch Delaware River; the Prompton and Dyberry Reservoirs in the Lackawaxen basin; the Bear Creek flood control reservoir in the Lehigh River basin; the Wallpack Bend Reservoir on Delaware River; and the Delaware River channel improvement below Trenton, New Jersey. He urged that there be no delay in constructing these projects. He also called attention to the formation of the Delaware River Basin Survey Commission by the four State Governors and the Mayors of New York and Philadelphia.

31. Mr. Robert A. Harrier, Managing Director, Lehigh Valley Flood Control Council, stated that the Council urged the immediate initiation of construction of Bear Creek Reservoir, as well as the construction of the planned flood protection works at Allentown, and Bethlehem, Pennsylvania, and that these projects be given top priority. The Council also recommended active consideration of local flood protection at Easton, Pennsylvania, and at Weissport, Pennsylvania, to augment the minimum protection to be afforded by Bear Creek Reservoir.

32. Colonel A. M. Heritage, Chief of Civil Defense, Bucks County, Pennsylvania, stated that Bucks County had suffered a loss of about \$16,840,000 and one life during the August 1955 flood. He urged that flood control be provided for Neshaminy Creek and along Delaware River in Bucks County.

33. Mr. K. A. Gillespie, Honesdale, Pennsylvania, gave a resume of floods and flood damage for the Honesdale and Dyberry areas dating back as far as 1865. He urged that immediate action be taken to construct flood control dams at Prompton and Dyberry to provide flood protection for the Lackawaxen River valley, for which the people of that area have been waiting for fourteen years. He also pointed out that Honesdale was ready and willing to cooperate on the project.

34. Mr. Michael Perche, Burgess of Hawley, Pennsylvania, stated his borough is on Middle Creek where it joins Lackawaxen River. He urged that something be done to improve channel conditions there so that the town would not be washed out during the spring thaw.

35. Mr. Kermit G. Beltz, Burgess of Weissport, Pennsylvania, reviewed damage and loss of lives resulting from floods in that area throughout the years. He emphasized the great damage caused by the flood of June 1862 in which 150 lives were lost between White Haven and Easton, Pa. He stated that a dam at Bear Creek would afford some

relief to Weissport, but urged that additional flood protection be provided for this town. He stated that the following projects were absolutely necessary:

- a. Construction of a dike on the east bank of the Lehigh to extend three-quarters of a mile south of the borough;
- b. Reinforcing the existing dike at the northwestern end of the borough;
- c. Dredging of the present river channel through the borough;
- d. Removing of the dam across the river at Parryville, which creates ice jams and causes backwater.

36. Mr. S. L. Mapes, Chief Engineer, Central Railroad Company of New Jersey, stated that his company has a deep interest in the control of the Lehigh River because the railroad extends along that river for about fifty miles from Lehigh to Easton and has suffered heavy financial losses in four major catastrophes since 1902. He voiced approval of the proposed Bear Creek dam, and of the dike and levee construction proposed for Allentown and Bethlehem, Pennsylvania, and offered the railroad's cooperation on the investigation.

37. Mr. Jesse R. S. Flory, Mayor of East Stroudsburg, Pennsylvania, expressed hearty approval of the Engineers' plans and pledged the complete cooperation of his borough.

38. Mr. H. H. Harris, Mayor of Stroudsburg, Pennsylvania, stated that the Borough of Stroudsburg had carried out extensive channel improvements on both Brodhead and Pocono Creeks through the town prior to the August 1955 flood; that the borough had suffered millions of dollars of damage in that flood; and that it would cooperate 100 percent on plans for flood protection.

39. Mr. George T. Robinson, Borough Solicitor, Stroudsburg, Pennsylvania, stated that his borough had suffered six major floods since 1860 and that while loss of life in the August 1955 flood was small, the town was one of the points where major property damage, in millions of dollars in all classifications, occurred. He also stated that although the borough was principally interested in alleviating flood danger in Stroudsburg, it would support any measures for flood control and better utilization of the resources of the whole watershed.

40. Mr. Warren Luckenbill, retired locomotive engineer, Lehigh-ton, Pennsylvania, read a petition signed by 192 citizens of Weissport, requesting that the levee on the east side of the Lehigh River in the vicinity of Weissport be extended seven-tenths of a mile south, and that Lehigh River be dredged in the vicinity of Weissport. The petition also requested technical and financial assistance for this work.

41. Mr. Harold E. Albert, Supervisor of Stroud Township, Monroe County, Pennsylvania, stated that his township surrounds the Borough of Stroudsburg and suffered great loss in the August 1955 flood. He requested that flood protection be provided in that area along Brodhead and Pocono Creeks. He proposed channel improvements and levees along these creeks and especially impounding dams on Brodhead and Pocono Creeks to prevent rapid runoff.

42. Mr. A. M. Slee, Public Health Coordinator, Monroe County Civil Defense, stated that the importance of water resources to public health and future industrial development in the entire community cannot be overestimated. He expressed hope that future planning would give serious consideration to water resources and their utilization as well as to flood control problems.

43. Mr. Charles R. Kluck, Sanitary Engineer, Pennsylvania Department of Health, Harrisburg, Pennsylvania, stated that his Department would be glad to supply any information it had on public water supplies, community sewer systems, and sewage plants to augment this investigation.

44. Mr. John DeKorte, Milanville, Pennsylvania, described general flood conditions in the Milanville community caused by Delaware River and Corcoran Creek. He requested that further study be made of Corcoran Creek with possible construction of flood retention basins, and dredging of a channel in the creek.

45. Mr. Kennard Lewis, Lawyer, East Stroudsburg, Pennsylvania, stated he owned property in Dingmans Ferry on Delaware River and that he understood that the Wallpack Bend reservoir would submerge most of this village as well as part of the village of Bushkill, Pennsylvania. He proposed that lower dams be built at Tocks Island, Belvidere, and near Easton, instead of the higher dam at Wallpack Bend. He pointed out that these smaller reservoirs would greatly enhance recreation resources in both Pike and Monroe Counties as well as some in Northampton County.

46. Mrs. Alice Britton, Bushkill, Pennsylvania, read a statement by her husband, John Britton, recommending four steps to be taken to control small rivers, creeks and streams in the area. These are: (1) clear the stream channel of debris, where advisable restore their original courses and where necessary, reinforce the banks; (2) extend State inspection of the construction and maintenance of small lakes and ponds with areas of one acre or more in the Pocono area; (3) construct secondary dams and controlled detention basins at strategic points to regulate flood flows; (4) establish and train a corps of flood wardens, who would watch the streams and issue flood warnings through a central control office. Mr. Britton urged that immediate action be taken to construct the Wallpack Bend project.

47. Letters, briefs and meoranda were submitted in connection with the hearing, and expressed views as follows:

a. Chief Burgess, Milford Borough, Pennsylvania, by letter, presented a brief resume of the flood damage along Sawkill and Vandermark Creeks and Delaware River at Milford, Pennsylvania. He recommended that flood control along the creeks consist of channel clearing and improvement of alignment. He also stated that it was estimated that construction of Wallpack Bend Reservoir would eliminate about \$32,070 of assessed real estate values in Milford Borough by inundation.

b. City of Easton, Pennsylvania, submitted, by letter, a statement prepared by the City Engineer giving data on floods suffered in the past by that city and flood damage caused by the August 1955 flood. The letter stressed that steps to protect property and health and safety in Easton were urgently needed.

c. Mr. John C. Thompson, Executive Engineer, New York State Water Power and Control Commission, submitted a statement and pointed out the reduction in Delaware River floods produced by the joint action of the Delaware River Master, U. S. Geological Survey, and the City of New York Board of Water Supply in lowering the pools in Pepacton and Neversink Reservoirs in anticipation of the August 1955 flood and storing water during this flood. He stressed the value of storage reservoirs in reducing flood crests and urged their consideration.

d. Chamber of Commerce, Easton, Pennsylvania, submitted a letter in which it urged the immediate construction of Bear Creek Reservoir and the other parts of the Lehigh River flood control project; that a similar plan for flood control be developed for Delaware River; and that as soon as the Delaware plan was completed, that it be constructed immediately to avoid future disasters caused by floods.

e. The Delaware, Lackawanna and Western Railroad, submitted a letter giving an estimate of the damage sustained in the Delaware River basin by that line. The letter stated that there was a definite and urgent need for flood control on Delaware River and its tributaries; requested prompt and thorough action by the Corps of Engineers to provide flood control; and pledged cooperation of the railroad on this work.



V PUBLIC HEARING AT TRENTON, NEW JERSEY  
20 JANUARY 1956

48. This was the third of the public hearings held after the August 1955 flood. It was held in New Jersey at the lower end of the flooded area in order to give the residents and interests in that area an opportunity to express their views regarding the investigation proposed. It also afforded an opportunity for them to present data regarding flood damage in this area.

49. Senator Wayne Dumont, Jr., Warren County, New Jersey, President of New Jersey State Senate, pointed out that aside from a flood control problem along Delaware River, the northeastern metropolitan part of New Jersey had a water supply problem. Therefore, that State was vitally interested in the construction of Wallpack Bend as a multiple-purpose reservoir. He also stated that recreation on this reservoir should be given full consideration, as well as use of the water to augment low flows in the river below Trenton for salinity control. Senator Dumont cited the following reasons why Wallpack Bend should be constructed and operated as a multiple-purpose reservoir: (a) it would provide a much needed water supply facility for northeastern portions of New Jersey; (b) it would result in augmentation of the low flow of the river downstream, at all seasons of the year, as desired by Pennsylvania; (c) the flow regulation would prevent the excessive salt water intrusion which South Jersey residents fear will result if the Delaware River channel is dredged above Philadelphia to Trenton; (d) the recreation facilities provided would benefit residents of New Jersey, New York and Pennsylvania. Mr. Dumont requested that the Federal government participate in the project to the extent of providing the flood control facilities required.

50. Dr. Thurlow C. Nelson, Chairman of the New Jersey Water Policy and Supply Council, New Jersey Department of Conservation and Economic Development, referred to a report by Powell-Leggette-Brashears, dated May 1954, which dealt with the relation of subsurface supplies to river flow in the Camden-Philadelphia area. He stated that the Council was concerned since this report indicated that isochlor 50 with comparable flows advanced between 1940 and 1952 some eight to twelve miles upstream in Delaware River. This advance was apparently caused by the channel deepening, or rising sea levels, or both. Dr. Nelson stated that any diversion of water out of the river must result in a permanent increase in salinity of Delaware River and Bay regardless of compensating releases. He requested recognition of the conflict between the interests of northern New Jersey, and those of lower Delaware Valley and of Delaware Bay. He stated that use of the entire New York and New Jersey diversions will result in bringing almost the entire natural oyster producing area into the realm of the most dangerous marine enemies. Dr. Nelson stated that the shad industry, which formerly amounted to two-and one-half million dollars per year, has been reduced to about 1/20th of that amount due to stream pollution but that this industry could be

saved if a reservoir were constructed from which a substantial quantity of water could be released for this purpose. He stated further, that the ultimate needs for water in New Jersey will require maximum development of the intrastate streams, plus the State's fair share of the waters of the Delaware.

51. Mr. George R. Shanklin, Acting Director and Acting Chief Engineer of the Division of Water Policy and Supply, New Jersey Department of Conservation and Economic Development, stated that the Division concurs that there is a need for a review of previous reports dealing with the water resources of Delaware River in view of: (a) the adoption of the 40-foot navigation channel between Philadelphia and Trenton; (b) the large increase in ground water recharge to the Raritan formation from Delaware River due to heavy pumping near Camden, New Jersey; (c) the amended U. S. Supreme Court decree of 1954 which increased diversions allowed New York City and New Jersey for water supply; (d) the reciprocal legislation enacted by Pennsylvania and New Jersey authorizing construction of the Wallpack Bend dam and reservoir for water supply and low flow compensation; (e) the immediate need for additional water supply for the northern New Jersey metropolitan area; (f) the disastrous flood of August 1955; and (g) an indicated change in hurricane tracks along the Atlantic coast. He stated that the Division concurs that a water resources development plan for the Delaware basin is needed, and that it should include developments not only for flood control, water supply, and hydroelectric power but also provisions for irrigation, recreation, abatement of stream pollution, preservation of fish life and shell fisheries, and the protection of the ground water resources of South Jersey from possible salt water intrusion. He pointed out the great damage and destruction caused in New Jersey by the August 1955 flood and stated that even greater damage might have occurred in that State if the storm causing the flood had been centered further to the east. He stated further that the Division concurs that flood detention reservoirs are desirable on tributaries for local protection, and that flood protection should be incorporated into water supply and stream-flow regulation reservoirs where compatible with their primary use. He stated that channel improvement and walls and dikes should be considered for local protection of industrial centers and residential communities, particularly along New Jersey streams. He requested that consideration be given to establishing a flood warning system, preferably with the U. S. Weather Bureau, and that specific areas be designated by the Corps of Engineers where flood plain zoning would be merited. He pointed out that the channel improvement project at Mount Holly, New Jersey, was the only completed flood control project in the Delaware basin portion of New Jersey but that the U. S. Soil Conservation Service was undertaking channel improvement on Pequest River near Great Meadows, Warren County, New Jersey. He urged that in the restudy of the basin, consideration be given to early construction of Wallpack Bend Reservoir as an integral part of the development of Delaware River and that the study determine the degree of Federal participation for

flood control that can be justified in this project. He pointed out that New Jersey has opposed applications for private hydroelectric power development on the ground that these would create vested rights that would have to be purchased later when the river was needed for the primary purpose of water supply. The State considers water power as an incidental benefit from the operation of reservoirs for stream flow regulation. He stated that the Division would be glad to cooperate in every way practicable to facilitate the completion of this much needed plan.

52. Commissioner Joseph E. McLean, New Jersey Department of Conservation and Economic Development, stated that the Department was deeply interested in utilizing the resources of the Delaware River basin, and that he felt they should be developed under a coordinated plan with the cooperation and participation of public agencies at all levels of government and not at a single governmental level. He pointed out that the deeper channel in the Delaware, from Philadelphia to Trenton, was important to New Jersey's welfare but so was the development of the State's water resources. The supply within the State even when fully developed is not expected to be sufficient for the needs of industry and the public, so that the State must develop and use its fair share of the water in Delaware River. This share he stated had been estimated at 300 million gallons of water per day. He also pointed out that development of the deeper channel in the river would further expose the Raritan aquifer to pollution from salinity in the Delaware River water and this must be avoided by increasing the fresh water flow by upstream storage. He stated this storage could be partially provided in the Wallpack Bend reservoir and that he was thoroughly convinced that the construction of this reservoir is fully in the interest of Pennsylvania and New Jersey. This reservoir, in addition to providing additional water for water supply, would also augment low flows in the river to reduce pollution and salinity intrusion, and aid fish and wildlife. It would also provide additional much-needed recreational facilities. He concluded by heartily indorsing the comprehensive survey and offering the fullest cooperation and assistance of the State of New Jersey.

53. Mr. Theodore J. Langan, Director of Planning and Development, New Jersey Department of Conservation and Economic Development, stated that deepening of the channel is of vital importance to the economic growth of the state, and that his agency envisions Philadelphia Harbor as becoming the greatest harbor in the world. He expressed the concurrence of his department with the recommendations of the report prepared under provisions of House Document 308, and urged restudy of the entire project to bring these recommendations up-to-date.

54. Governor Robert B. Meyner, State of New Jersey, stated that the development of the Delaware River is no longer a matter for leisurely discussion but a major issue with profound implications for the welfare of all the citizens of the four states in the Delaware River valley; the full benefits of this river system can be realized only through an integrated program of multiple-purpose development; and that the Federal government should have a broad interest in its development and should participate, since it is an interstate waterway of considerable national significance. He reiterated New Jersey's interest in the various phases of the water resources development as discussed by members of his staff and emphasized that in the future New Jersey will be forced to utilize the water resources of the State to the greatest extent possible and also to draw heavily upon Delaware River for additional water supply.

55. Mr. Oscar R. Wilensky, Counsel of the North Jersey Water Supply Commission, read a letter, prepared by the Chairman of the Commission, which explained that the municipalities of Bayonne, Elizabeth, Hillside, Kearny, Newark, Orange, Cedar Grove, and Bloomfield, New Jersey, had filed petitions with this commission for additional water supplies; that the Commission had prepared a report entitled "Round Valley Project for the Metropolitan Section of the North Jersey Water Supply District;" and that this project was expected to be approved in the near future. The letter also pointed out that although the first stage of this development would divert the water required from the South Branch, Raritan River, later stages would require the pumping of 230 million gallons of water from Delaware River at Frenchtown, New Jersey. The letter requested that the diversion rights for pumping at Frenchtown be preserved and that flood control developments be so designed as not to interfere with the future exercise of these rights. Mr. Wilensky explained and further emphasized the need for developing the Round Valley project and for diverting 230 million gallons of water per day from Delaware River for use in Northern New Jersey.

56. Mr. Henry W. Peterson, Secretary, South Jersey Port Commission, stated that the Commission is in favor of the 40-foot navigation channel; is interested in flood control; and thinks that a dam should be constructed above Trenton as a precautionary measure to prevent any detrimental salt water intrusion from advancing up the lower river.

57. Mr. John Roach, Jr., representing the Morris County, New Jersey Board of Freeholders, stated that the State of New Jersey wants to deplete Morris County's water resources for other parts of the state before drawing on those of the Delaware River. He also stated that the present rate of growth indicates that Morris County will be put in the position of begging for water from the Delaware



River in the future, when the water in the County is being used elsewhere in New Jersey. The County Board feels that it is time for action and that the Corps of Engineers should find a solution to this problem in this investigation.

58. Mr. A. H. Underhill, Director, New Jersey Division of Fish and Game Commission, stated that there is a mushrooming demand by New Jersey citizens for outdoor recreation, much of which can be furnished by wise management of their fish and game resources. He explained that major changes in the environment of fish and wildlife can be harmful and urged that appropriate state and Federal conservation agencies be permitted to cooperate in developing the comprehensive water resources plan. The Director pointed out: (1) that the marshes bordering the Delaware River and Bay are breeding grounds and wintering areas, or migratory stops, for hundreds of thousands of waterfowl; (2) that the dumping of channel spoil in these areas would reduce this habitat, which accounts for millions of dollars being spent by more than 350,000 gunners; (3) that dams on the tributaries could eliminate many miles of principal trout streams that provide nearly 500,000 man-days of sport annually; (4) that plans are now materializing for the rehabilitation of the Delaware River shad fishery, but fishways over dams must be provided if shad are to spawn and the young reach the sea.

59. Mr. Lewis Klockner, Water Supply Engineer, speaking for the Commissioners of the City of Trenton, stated that the city derives all of its water from the Delaware River and that water supply is its most important problem. The city is improving its system and is vitally interested in low flows at Trenton. The Commissioners feel that the interests of Trenton will be served best by construction of the Wallpack Bend dam. They are in favor of the proposed investigation and are particularly interested in its water supply and flood control features.

60. Mayor Harold Smith, Town of Belvidere, New Jersey, stated that the town has three dams on Pequest River in the radius of one mile, and this river also cuts the town in half. He pointed out that the town fears that if the U. S. Soil Conservation Service dredges a new channel through the Great Meadows area above Belvidere, it would increase floods in this river at Belvidere. He requested the Corps of Engineers to give consideration to the Pequest River basin and to determine the effect of the Great Meadows project on floods at Belvidere.

61. Mr. Frank Boheren, Municipal Engineer of Hunterdon County, New Jersey, stated that he represented all communities from the City of Lambertville to the Township of Pohatcong. He outlined some of the flood damage produced by the 1955 flood and recommended that Pennsylvania, New Jersey, and the Federal government act jointly and immediately to install sufficient structures on the upper watersheds,

and at least one major dam on the Delaware River, to cut the flood peaks at least ten feet. He also urged that one agency be assigned the responsibility for a flood control plan and for securing the cooperation of all interested parties.

62. Mr. William H. Baumer, representing the New Jersey State Chamber of Commerce, brought out the many reasons why that State should be growing apace with other states, and blamed the failure to do so on lack of water supply and water control. Mr. Baumer suggested that the people seek, through all levels of government, an integrated solution to the problems of flood control, water supply, stream regulation, pollution abatement and conservation of all interstate waters, and that they support multi-purpose use of the waters of the Delaware basin insofar as they refer to New Jersey.

63. Mr. Malcolm P. Crooks, representing the Stony Brook-Millstone Watershed Association, urged that the U. S. Department of Agriculture and the Corps of Engineers cooperate on this study to insure its being carried out on a multiple use basis for the benefit of the entire basin.

64. Mr. C. F. Mohr, Professional Engineer from Pennsylvania, suggested impounding as much water as possible in the small dams on the tributary streams to replenish the water table and increase low flows. They would also aid wildlife conservation. He stressed his opinion that too much faith should not be put in one large storage dam but that preference should be given to small control dams located over wide areas.

65. Mr. Allen Ward, New Hope, Pennsylvania, publisher of the New Hope Gazette, gave information on flood damage at New Hope, Pennsylvania, and requested that the Corps of Engineers include a study of flood control measures for Cuttalousa and Paunacussing Creeks. He also called attention to the necessity for including intangible flood damages in flood control investigations and pointed out some of them suffered in New Hope.

66. Letters, briefs and memoranda were submitted by other interests in connection with the hearing, and expressed views as follows:

a. Mr. Fred H. Larson, U. S. Soil Conservation Service, Upper Darby, Pennsylvania, by letter, furnished information showing the Soil Conservation Districts organized in the New Jersey portion of the Delaware River watershed. He called attention to other activities of his agency in the area under Public Law 566, "Watershed Protection and Flood Prevention Act." He stated that ground water supplies appear to be critically short in parts of southern New Jersey; that there is much local interest in this problem; and that any substantial improvement in these supplies would be welcomed.

b. Mr. Charles W. Coward, Mayor of Riverton, New Jersey, listed in a letter, three methods which, in the opinion of that community, can best provide flood control. These were: (1) construction of check dams and reservoirs in and along the Delaware River and its tributaries north of Trenton, New Jersey; (2) prevention of the filling-in of marshes and lowlands along the river south of Trenton and; (3) by not deepening the channel of Delaware River to a depth of 40 feet. The community also took exception to the government's requirement that local interests provide assurances that they will hold and save the government free from damages that may result from flood control projects.

VI PUBLIC HEARING AT PHILADELPHIA, PENNSYLVANIA  
27 JANUARY 1956

67. This was the fifth and last public hearing held as a result of the Congressional resolutions of 13 April 1950 and 14 September 1955, to secure the views and desires of various interests, organizations and individuals in the objectives and outcome of this investigation.

68. Mr. Frederick Nevins, Sanitary Engineer, U. S. Public Health Service, New York, New York, had no statement to make, but presented, for consideration, five reports on water pollution control in the Delaware River basin. These reports were prepared by the Public Health Service in cooperation with the respective states and INCODEL, and contained a great deal of information on pollution and sanitary conditions in the basin.

69. Mr. Maurice K. Goddard, Secretary of the Pennsylvania Department of Forests and Waters, stated that as a result of the disastrous flood of August 1955, his Department felt that the Federal government had every reason to join Pennsylvania and New Jersey and participate in the construction and future operation of the Wallpack Bend project. Mr. Goddard also stated that the Department believed the Delaware River channel should be 40 feet deep and should extend from Trenton to the Bay. He urged that both of these projects be undertaken as soon as possible.

70. Mr. Clayton M. Hoff, Chairman, Delaware Commission on Interstate Cooperation, stated that the State of Delaware is interested in Delaware River for transportation, for cooling water, for industry, for fresh water and well water adjacent to the river, for recreation in the form of fishing and hunting and for the large business growth in the form of the oyster industry. He also stated that any program which would accomplish flood control by retarding the flow of excessive quantities of fresh water during the floods, and by releasing the flow during droughts, would reduce the salinity of the lower part of the Delaware River and Bay, and would thus be of the greatest benefit to the oyster industry and to Delaware. Speaking for the people of the Brandywine Valley, he requested that the survey by the Corps of Engineers include a proportionate amount of flood control storage in reservoirs required for water supply use. He urged that consideration be given to reducing flood damage by the imposing of flood plain zoning in areas subject to overflow. He stated that the State of Delaware indorsed the program which will involve a comprehensive water supply program for the entire Delaware River basin as well as a natural resources development and management program for the same area.



71. Mr. John T. Welsh, President of the Board of County Commissioners, Bucks County, Pennsylvania, presented a report detailing the need for a comprehensive flood control program in the Delaware basin. Mr. Welsh said Bucks County is affected not only by Delaware River, but also by Neshaminy Creek which starts in Bucks County near Chalfont and empties into the Delaware River at Bridgewater, below Bristol. He added that the Board was ready to assist and to work with the Corps of Engineers towards the solution of these problems.

72. Colonel A. M. Heritage, Civil Defense Director, Bucks County, Pennsylvania, gave a report, received by him to the effect that spoil from dredging in the lower Delaware River by the Corps of Engineers was affecting natural drainage in portions of Bensalem Township and flooding a portion of State Road No. 13. This road is used as a Civil Defense road, and Colonel Heritage requested the Corps of Engineers to consider remedial measures to correct this impediment to safety.

73. Mr. Robert F. Miller, County Engineer, Schuylkill County, Pennsylvania, spoke in behalf of the County and the Borough of Tamaqua. He presented a report on the flood situation in the Tamaqua area. It gave a physical description of the areas, a history of the floods, and contained the following recommendations: (a) That the channel of Little Schuylkill River be cleaned of debris and small islands and be dredged through the Borough and downstream; (b) that permanent levee-type retaining walls be constructed along its banks within Borough limits; (c) that a detention reservoir be constructed on this river north of Tamaqua. The report pointed out that the Pennsylvania Department of Forests and Waters had recommended in 1951 the construction of a detention reservoir across Wabash Creek west of Tamaqua, and an auxiliary tunnel under the town, to carry off excess flood waters of Wabash Creek. Mr. Miller stated that a long-range program for back-filling abandoned strip mines and for extensive reforestation in the watershed should be adopted. He stated that, inasmuch as the Borough of Tamaqua is in a distressed economic area, the total cost of these improvements should be borne by the Federal Government.

74. Mr. E. Budd Marter, Director of Civil Defense, Burlington County, New Jersey, described the flood situation in Cinnaminson Township, Burlington County, and stated that a large dike along the river has disappeared, and its loss creates a constant flood danger to portions of East Riverton. He also stated that rising tides along the east side of Pennsauken Creek from Route 130 to the Cinnaminson line cause flooding in that area. He requested the Corps of Engineers to take corrective measures since the people in this area are financially unable to do so.

75. Mr. Samuel S. Baxter, Water Commissioner, City of Philadelphia, listed briefly some of the problems which he believed to be of general interest in the development of the Delaware River basin and of particular interest to Philadelphia. These included flooding in Philadelphia due to a combination of upriver floods and high tides; damage to Fairmount Park by floods in the Schuylkill River; damage to parts of the city by floods in Darby, Pennypack, and Wissahickon Creeks. He pointed out that Philadelphia may want to go to upland sources for additional water supply some time in the future and that any comprehensive plan should provide for Philadelphia to divert water from Delaware River above Trenton with Wallpack Bend dam and a low diversion dam at Yardley considered as possibilities. He stated that although pollution in Delaware River has been reduced, a continuing program is needed to protect Philadelphia's water supply and provide a clean waterfront. Salinity control is needed to protect the city water supply and to continue to provide fresh water for industry. He felt that continued consideration should be given to developing the Wallpack Bend reservoir for low-flow augmentation and for flood control. He stated that Philadelphia would have a real interest in the use of any recreation areas that would be built upstream as a part of the basin development program. The City would also be interested in any soil conservation measures upstream that would eliminate large quantities of silt which add to the cost and decrease the capacity of the city filtration plants. He mentioned the city's interest in a deeper navigation channel and stated that hydroelectric power development should be included in any comprehensive plan of development. He stated that the City of Philadelphia would be glad to cooperate in the comprehensive investigation.

76. Mr. Harold S. Finigan, Councilman of Darby Borough, Pennsylvania, requested that reasonable and adequate ground be acquired along the perimeter of Darby and Cobbs Creeks to construct and maintain channels with a depth of six feet, or better, where possible, for flood control, sanitation and recreation. Also that all encroaching obstacles be removed and kept from the creek.

77. Mr. Charles R. Witmer, Borough Secretary, Sellersville, Bucks County, Pennsylvania, stated that Sellersville is confronted with a 27-1/2 square mile drainage area of Perkiomen Creek which discharges through the center of Sellersville. This caused flooding U. S. Highway No. 309 during the flood of August 1955 and halted all traffic. Mr. Witmer requested assistance in solving the flood problem at Sellersville.

78. Mr. Allston Jenkins, President, Philadelphia Conservationists, Inc., expressed concern that the Army District Engineer staff, which is being assembled to make the report, contains almost every kind of expert except a conservationist, biologist, wildlife management technician, or any person of similar profession. He requested

that the conservation, fish, and game departments of the four states concerned, as well as the U. S. Fish and Wildlife Service, be consulted in connection with the survey and that the personnel of the Report Group include a professionally trained conservationist.

79. Mr. John Henry Reiners, Jr., Vice-Chairman, Delaware Valley Council, expressed the Council's endorsement of efforts to organize local watershed associations on the smaller tributaries of the Delaware. He stated that the Council offered the following five recommendations pertaining to a comprehensive survey: (a) that the initial step be the construction of an impounding dam at Wallpack Bend; (b) that all development and construction programs insure continued improvement in the characteristics of the river water for industrial use; (c) that the Corps of Engineers, upon sufficient mandate from Congress, undertake early improvement of navigation channel in the Delaware River north to Trenton; (d) that the Corps of Engineers study the need for additional anchorages in the Port Area, and (e) that attention be given to the development of programs designed to effect the early reconstruction, or replacement of the Tacony-Palmyra and Burlington-Bristol drawbridges. He offered the cooperation and support of the Delaware Valley Council.

80. Mr. Dewitt C. Clement, Philadelphia Chamber of Commerce, expressed the concurrence of that body in the recommendations made by the Delaware Valley Council.

81. Mr. Waldorf Ringe, representing the Pennsylvania Federation of Watershed Associations, expressed the concurrence of that organization in the recommendations made by the Delaware Valley Council.

82. Mr. Edward E. Garlits, representing the Yardley, Pennsylvania, Flood Control Committee, expressed the appreciation of the people of Yardley for emergency flood assistance by the Corps of Engineers following the August 1955 flood. He stated that Yardley feared that the new high level bridge to be erected by the Joint Delaware River Toll Bridge Commission and its approaches would increase flooding in that area. They also feared that the new freeway that was being constructed along the old canal bed from the center of Trenton to the Yardley vicinity would also increase flood damage in that vicinity by restricting the flood plain. He requested that full consideration be given to the design of these structures in order to eliminate possible additional future flooding.

83. Mr. F. W. Biltz, Chief Engineer, Reading Railroad Company, stated that during the August 1955 flood the company's trackage between Tamaqua and New Ringgold was put out of service for approximately two weeks. The estimated damage was three-quarters of a million dollars, aside from the intangibles. He requested stream clearance, including the removal of boulders and out-cropping ledges of rock, along Little Schuylkill River.



84. Mr. A. G. Hillberg, Consulting Engineer for the Delaware River Development Corporation, described the plans of this company to construct dams on Delaware River at Tocks Island, Belvidere, and Chestnut Hill for hydroelectric purposes. The dam at Tocks Island is the only conflict with the plan proposed by INCODEL. He stated that the latter agency is proposing a dam at Wallpack Bend instead of Tocks Island and cited the advantages and disadvantages of a dam at either of these sites. He also stated that he expected action on the company's pending application, before the Federal Power Commission, for a preliminary permit within a matter of weeks. He requested that the project of the Delaware River Development Corporation be included in the current consideration of the Corps of Engineers.

85. Mr. C. F. Mohr, Professional Engineer, Delaware County, Pennsylvania, called attention to wing dams used in improvement of Upper Mississippi River. He suggested similar rock impounding dams be constructed in Delaware River to retard floods.

86. Mr. Walter Rosengarten, Lower Merion Township, Pennsylvania, requested some means be found to retain Flat Rock Dam on Schuylkill River which is in a bad condition, and which would create considerable damage downstream, if it were washed out. He also stated that he was interested in local flood problems on minor tributaries of the Schuylkill River in Lower Merion Township and needed help in solving debris problems on these streams.

87. Letters, briefs and memoranda were submitted by other interests in connection with the hearing and expressed views as follows:

a. Mr. Fred H. Larson, U. S. Soil Conservation Service, Upper Darby, Pennsylvania, by letter, furnished a list of the Soil Conservation Districts in the lower portion of the Delaware River basin in Pennsylvania and Delaware. He also outlined the activities of the Soil Conservation Service in the area under Public Law 566, Watershed Protection and Flood Prevention Act, as well as under the Pilot Watershed Program. He called attention to prior reports on the Delaware River basin prepared by his agency.

b. Interstate Commission on the Delaware River Basin, submitted a written statement which was summarized by Mr. Clarence F. Wicker of the Corps of Engineers staff. This statement recommended that one of the first steps in the survey should be the immediate review and reappraisal of the Wallpack Bend reservoir. The Commission considers that the main objective of the review and the reappraisal of Wallpack Bend Reservoir should be the formulation of a plan mutually acceptable to the United States Government, the Commonwealth of Pennsylvania, and the State of New Jersey for operation of that reservoir and the sharing of its cost on a true partnership basis. It recommended immediate construction of Bear Creek reservoir and the other elements of the Lehigh River flood control projects, and also the Prompton and Dyberry Reservoirs in the Lack-



awaxen basin. INCODEL summarized its views as follows:

(1) There is a need for further research to determine the probable future pattern, frequency and intensity of hurricanes and to devise measures for their control.

(2) There is a need for better flood and hurricane forecasting systems.

(3) There is a need for acceleration and expansion of programs for "watershed protection and flood prevention" as authorized by Public Law 566, and the integration of such programs into a comprehensive water resources development plan for the basin.

(4) There is a need for more effective flood-area zoning and for disaster warning systems.

(5) There is a need for the institution of a nationwide program for insurance to cover damages caused by disasters, including floods, droughts, hurricanes, earthquakes, tidal waves, tornadoes, and the like.

(6) There is a need for the establishment of a national policy for water resources control and development, to more evenly distribute the funds and revenues for this purpose.

c. Former Mayor Joseph S. Clark, of Philadelphia, sent a statement that was read by Mr. Walter M. Phillips. In this statement Mayor Clark stated that the term "comprehensive survey" meant one covering the entire Delaware River watershed and the adjacent areas immediately affected by it. That a multiple purpose survey was one that considers all relevant purposes that can be combined in a mutually-supporting manner in the development of a water resources plan. He concluded that the time had arrived when the states and cities would press for a new, comprehensive approach to development of the Delaware River basin; that the fullest economic potentialities of the development could be realized in a mutually-supporting plan in which local, State and Federal agencies would unite in developing, undertaking, and financing; that this plan should join the fullest economic possibilities for flood control, storage and hydroelectric power development, and the optimum possibilities for recreation, fish and wildlife and agricultural and forest land conservation and development, with such purposes as navigation, domestic, industrial and irrigation water supply, pollution, sediment and salinity control, and maintenance of stream flow in a truly multiple-purpose development; and that this plan should be jointly financed by local, State and Federal governments. Mayor Clark also concluded that the Federal government must play a greater role than in the past, in cooperating with the states and localities in surveying the water resources needs, problems and

potentialities of the region and in developing and carrying out action plans and that the need for such action was now. He sketched the action already taken by the Governors of the four States and the Mayors of New York City and Philadelphia in forming the Delaware River Basin Survey Commission in 1955 and stated that this Commission should work closely with the Corps of Engineers in developing the plan. He indicated that he expected the Commission to be directed toward the following activities: (a) studies of current and future resource requirements; (b) analysis of what should be included in the integrated development plan; (c) examination of alternative means of governmental organization and administration necessary to carry out a river basin development; and (d) leadership in increasing public understanding of the basic problems and support for needed solutions. These he looked upon as supplementing and making more effective the investigations and studies of the Corps of Engineers.

d. Planning Commission of Delaware County, Pennsylvania, Media, Pennsylvania, by letter, expressed a keen interest in the survey and the desire to coordinate studies they were making for Darby Creek with the general investigation.

e. Mr. John P. Fullam, Solicitor for Borough of Bristol, Pennsylvania, by letter, furnished flood damage data for the Bristol area, and requested that steps be taken to end flooding in this area.

f. Mr. Angus T. Johnson, Township Manager of Middletown Township, Langhorne, Pennsylvania, by letter, called attention to the following matters: (1) flood control works should be constructed on Neshaminy Creek either by stream improvement and/or construction of a water control reservoir upstream from Middletown Township; (2) reconstruction of a bridge across the Neshaminy in Brownsville Road, which was destroyed by "Diane," should be designed to provide for full channel width and excessive flood level; (3) investigate whether water, impounded by the Philadelphia Suburban Water Company at Neshaminy Falls and dam at Hulmeville, could be released to coordinate with a flood level, so that water would not be backed up beyond its normal storage basin; (4) revise or improve channel location of Neshaminy Creek, as it enters Langhorne Terrace, so that flood waters would not bound off the cliffs on the western side of creek and be directed at this residential development.

g. Mr. Elmer F. Hansen, President, Fort Washington Industrial Park, Fort Washington, Pennsylvania, in a letter, requested relief from the flooding caused by the backing up of Sandy Run Creek between the Bethlehem branch of the Reading Railroad and Wissahickon Creek.

h. The Lukens Steel Company stated in a letter that it had initiated certain steps to eliminate recurrence of flooding on Brandywine Creek and Sucker Run, that cost it approximately \$1,375,000 during the past summer. The letter stated that further control by the company is prevented by certain authoritative limitations and requested that a government agency, with jurisdiction, exercise the controls necessary to prevent recurrence of such flooding.

VII PUBLIC HEARING AT WILMINGTON, DELAWARE  
20 OCTOBER 1958

88. This public hearing was held as a result of a resolution adopted by the Senate Committee on Public Works, dated 28 April 1958, which directed that the review of previous reports being made by the Corps of Engineers in conjunction with the comprehensive survey of the Delaware River basin, consider the feasibility of constructing a barrier in the Delaware River estuary. The hearing was held to secure the views and desires of various interests, organizations, and individuals in the objectives and outcome of this phase of the comprehensive water resources investigation.

89. Honorable J. Caleb Boggs, Governor, State of Delaware, stated that the State of Delaware is becoming increasingly cognizant of the seriousness of its future fresh water situation. He pointed out that in December 1954 he had appointed a Water Resources Study Group for the State and that this Group is actively making a study of the hydrology of the state and plans for the future use of its water resources. He stated that the physical terrain of Delaware presents problems for impoundment; that the saline borders of the state endanger the recharge of its underground sources; and that the State's streams have little potential value as fresh water suppliers. He felt that the very future existence of the State necessitates a dependable and visible source of proper quality water from beyond the borders of the State or from Delaware River. The Governor pointed out that it is a question of security for the State, weighed by economy and practicability; a question of miles of aqueduct through heavily populated areas at a tremendous cost or a river of proper quality at its door. Therefore, the State of Delaware is vitally interested in the study of a barrier in the estuary.

90. Captain P. R. Osborn, representing the Commandant, Fourth Naval District, Philadelphia, stated that the proposed barrier might result in costly delays for shipping and would curtail the expeditious passage of naval vessels; also, that a national security problem would arise if the locks should be destroyed, thereby blocking both commercial ships and naval vessels in the estuary. Construction of a barrier would block the tidal flow and create a slack fresh water pool maintained at the present high water level. The Delaware Memorial Bridge presently has a clearance of 188 feet at mean low water. Reduction of this clearance by raising the water level beyond five feet above mean low tide is considered highly undesirable by the Chief of Naval Operations. Consideration should be given to the effect of a barrier on existing drainage systems, sewer and waste outfalls, also on flood heights above the barrier and to icing conditions during the winter season. He stated further, that maintaining the Reserve Fleet in fresh water would result in no change in cost and it is believed that the reduction in salinity is of no great interest to the Navy.



91. Mr. Lester M. Klashman, Sanitary Engineer, U. S. Public Health Service, New York, stated that the interests of that agency are municipal and industrial water supply, water pollution control and its effect on water quality and vector control. The Public Health Service has submitted a report on vector control to the Corps of Engineers for use in the comprehensive survey of the Delaware River basin. It is believed that conversion of the tidal section of Delaware River into a large fresh water lake will change the physical, chemical and biological characteristics of the area. The proposal to construct a barrier in the estuary will require further studies by the Public Health Service to analyze all the significant sources of waste discharged into the tidal basin; to study the problems inherent in re-using the water in the proposed pool; the effects of possible increased water temperatures on the rate and extent of chemical and biological reactions; evaluate the quality problems below the barrier; evaluate the cost of relocating and increased operation costs for existing sewers, treatment plants, and pumping stations; evaluate the detrimental effect of combined sewers in the metropolitan areas; and evaluate the possible concentration of atomic wastes in the pool.

92. Mr. M. A. Marston, U. S. Fish and Wildlife Service, Boston, Massachusetts, stated that this agency regards itself as neither a proponent nor an opponent of the barrier plan. Its position is that adequate studies must be undertaken before construction of a barrier is undertaken. He stated that Delaware Bay is one of the most productive inshore fisheries along the Atlantic coast and that the dock-side value of all fisheries landings, directly from Delaware Bay, varies from \$4,000,000 to nearly \$6,000,000 annually, about 90 percent of which is contributed by oysters from the bay. The total value of New Jersey and Delaware landings, including offshore fisheries, was over \$22,000,000 in 1954. The construction of a barrier would have an impact on the environment upstream from the project and possibly on maintenance of offshore fish productivity. Problems in fish passage would arise, and certain fish species, presently utilizing the river, might be excluded. On the other hand, a barrier could result in improvements in the habitat for fresh-water fish. The possible effects of pollution in the post-development period within the reservoir are a matter of concern; and if anadromous fish are to be restored to the basin and if the eel fishery is to be maintained, then fish passage will obviously have to be provided. He stated that factors such as changes in flow, sedimentation and salinity patterns, which would be brought about by the existence of a barrier, would have an impact on the estuarine life of the Bay but the net effect cannot be stated at this time. It may be detrimental or beneficial. It may be disastrous to some organisms in certain areas or in a widespread area. Certain species may respond very favorably to the new environment. The fisheries' interests should undertake preliminary studies after the Corps has determined the general feasibility of the project to

determine what influences fisheries considerations might have on the general feasibility of the project. He further pointed out that the Delaware Bay marshes form a most important factor in the migration, wintering and breeding of wildfowl as well as the most important single habitat block for production in the Northeastern and Middle Atlantic States. He feared that construction of a barrier might trigger a complex and interrelated set of reactions that would be detrimental to the fish and wildlife of the estuary and that an extensive study should be made of the estuarine ecology before any barrier project was undertaken.

93. Mr. Richard A. Haber, Delaware State Coordinator for the Delaware River Survey, stated that the State of Delaware is fully cognizant of its needs for water and is preparing an appendix for inclusion with the report of the comprehensive water resources survey which will point out the water resources and the needs for that State. He also stated that Delaware at the present time is the proponent of a barrier study, and not of a barrier, and that the feasibility of constructing such a barrier can only be determined after a full investigation of the needs and/or the problems connected with it.

94. Dr. A. Joel Kaplovsky, Director, Delaware Water Pollution Commission, stated that projections of the water supply needs of the State of Delaware indicated that its water resources were sufficient for only about one-half of its potential needs. Therefore, it must secure additional water from outside the State. One means would be aqueducts and pipelines through Philadelphia and Chester to bring water from above the end of tidal reach at Trenton, New Jersey. These would be costly and difficult to construct. The pool behind a barrier would provide an alternate source without such aqueducts. It would also provide possible fresh water recharge to aquifers under both Delaware and New Jersey, and increase underground storage. However, it would produce extensive sanitary problems as well as disrupt certain uses of the area by fish and wildlife. He urgently requested that not only a preliminary barrier dam study be instituted at this time but that it be considered as an integral part of upstream impoundment planning for fuller water availability in the Delaware River basin.

95. Mr. Joe S. Robinson, Assistant State Highway Engineer, Delaware State Highway Commission, compared the studies made in 1953-1958 by the State of California, for a barrier across San Francisco Bay, with those needed for a Delaware estuary barrier. He gave various data relative to navigation requirements, structural details, and foundation problems encountered. He pointed out that a thorough study of navigational requirements on Delaware River would have to be made as a part of the investigation for a barrier in the Delaware estuary.

96. Dr. Floyd H. Hudson, Executive Secretary, Delaware State Board of Health, stated that the State Board of Health has estimated that the population of New Castle County, Delaware, will increase from 302,000 in 1958 to more than 910,000 in 2010; that per capita water consumption in the 50-year period to 2010 will increase from 100 gallons to 125 gallons per day; that the daily demand for public water supplies in New Castle County will increase from 55 million gallons to 134 million gallons; that estimates of industrial and irrigation requirements greatly exceed these public requirements, and that the daily safe yield of available surface and ground water supplies in the county are somewhat less than 250 million gallons per day. Therefore, it appeared evident that Delaware must supplement its water sources and Delaware River appeared to be a logical supplemental source. He stated that the State Board of Health felt that the study should include the most practical and feasible method of supplying fresh water to the lower Delaware River basin as well as a study of a barrier in the estuary. He urged that the barrier study be included in the comprehensive water resources study.

97. Mr. Norman Wilder, Director, Delaware Fish and Game Commission, stated that the resources of the Delaware estuary provide diversified recreational and commercial enterprises; that sports fishing and commercial fishing are both multimillion dollar industries; and that the recreational use of the water is increasing with phenomenal rapidity. He further stated that a barrier dam would definitely result in environmental changes in both flora and fauna of the area. The barrier would create an extremely attractive fresh water fishing lake whose advantages might offset the losses of salt water fishing. He also recommended that a study be made of the diverse problems created and the many possible benefits and detriments to the very valuable fish and game resources in and along the Delaware estuary.

98. Mr. Eden F. Jones, Public Service Commission of Delaware, stated that there is a growing need for additional water supplies in the State of Delaware and that all potentials for increasing these supplies must be investigated. He urged that the barrier study be conducted to determine the potential of this source of water supply for the future needs of Delaware.

99. Mr. E. H. Talbert, State Drainage Engineer, Delaware Soil Conservation Commission, presented a brief prepared by Dean G. M. Worrilow, University of Delaware, and himself. This brief presented data on the use and needs for irrigation water in Delaware. It showed that the needs were increasing and that 1,554 million gallons were used in that State during the dry season of 1957 to irrigate 14,269 acres. He pointed out the sources used for this water and that there was a definite trend toward increased use for this purpose. He strongly urged a study to determine the feasibility of using a barrier to increase the supply of fresh water in the lower reaches of the Delaware River.

100. Dr. Paul Bock, Assistant Professor of Civil Engineering, University of Delaware, stated that studies indicated that the water needs of the State of Delaware are spiralling upward, and in 50 years the State will require five times the water it is using now. The Piedmont and Coastal streams under maximum development can supply only a fraction of the future water needs. Ground water sources will be insufficient to make up the deficit, and a barrier is one means of tapping a tremendous new surface supply. He urged that the barrier plan be studied as a means of providing an adequate source of water for the lower Delaware River basin.

101. Dr. Johan J. Groot, State Geologist of Delaware, reviewed studies of water resources available for supplying the needs for Delaware, as well as the magnitude of these needs. He stated that Delaware River offered one of the best solutions for supplying the additional potential needs for water in this State. He enumerated the following important advantages of constructing a barrier in the Delaware estuary: (a) it would store a large quantity of water (about 250 billion gallons) at Delaware's doorstep; (b) it would provide greater discharge than any other available stream; (c) it would prevent salt water intrusion into the major aquifers above the dam and provide potential fresh water recharge to these strata; (d) it would make it unnecessary to construct small, expensive storage dams on the small Piedmont streams; (e) it would reduce expensive channel dredging in Delaware River; (f) the fresh water lake would be a great asset in increasing recreation facilities of the region; (g) the benefits would be available to New Jersey and Pennsylvania as well as to Delaware. He admitted that many difficulties relating to navigation and pollution would have to be overcome, but he urged that the study be made as the best approach to solving the critical potential water shortage in Delaware.

102. Dr. Carl N. Shuster, Jr., Director of Delaware University Marine Laboratories, presented a lengthy statement pertaining to the biological productivity of the Delaware estuary. He pointed out that one of the important effects of a barrier in the Delaware estuary would be its probable impact upon coastal fisheries and upon the trend in man's greater dependence upon coastal areas for food production. He stated that not only the entire Delaware River basin, but also a large segment of the western Atlantic Ocean are essential parts of the ecology of the estuary. He presented data relating to the species and kinds of animals and fish in the estuary and to the annual commercial values resulting from them. He enumerated a number of effects to be expected from any change in the estuarine environment such as might be caused by a barrier. He emphasized that the fisheries of the estuary are valuable as a food source, for recreational fishing, and for industrial purposes. He insisted that the feasibility study for the barrier must go beyond an estimate of its effect on fisheries, and must report upon engineering involved in making a salt water barrier and associated structures that can provide increased seafood production commensurate with the predicted increase in human water consumption.



103. Mr. W. Compton Wills, Board of Water Commissioners for Wilmington, Delaware, pointed out some of the problems to be encountered in providing for the future water supply of Wilmington and its surrounding area, as well as some of the developments for that city. He pointed out that Delaware River represents a vast potential raw water source and urged that the preliminary barrier study be made.

104. Mr. Clarence S. Moore, New Castle County Water Resources Committee, pointed out some of the studies under way to determine Delaware's needs for water and of means to provide it. He stated that Delaware River represented the only real potential source of future water availability, and that detailed data and an engineering study are needed to establish the feasibility of securing water by means of a barrier. He urged that the study be undertaken promptly.

105. Brigadier General Norman M. Lack, Delaware Water Study Committee, summarized the testimony presented by the State of Delaware and stressed these main points:

a. Delaware is asking only for a study of the barrier proposal and not recommending any particular barrier at this time.

b. The day will soon come when the basin can no longer afford the luxury of wasting fresh water to hold back the salt water front in the estuary, and augmentation of flows for this purpose only increases this waste.

c. The State is fully cognizant of several problems that a barrier might create, but has confidence that they can be successfully solved.

d. A barrier would provide the greatest amount of fresh water, at the least cost, for the most people, especially in the lower Delaware basin.

e. It would create a fixed shoreline that would greatly improve recreation facilities and encourage the development of new waterfront industrial sites on both sides of Delaware River.

f. The increased depth and the one-directional flow would afford important advantages to water transportation, and to industrial water users.

g. A barrier would substantially reduce hurricane damages in the estuary by holding back the high water levels induced by these storms.

h. A barrier reservoir with its huge storage would afford the greatest insurance of water supplies to the most heavily populated areas and the largest industrial facilities within the Delaware River basin. General Lack concluded by urging that the barrier study be made. In some of the discussion which followed, General Lack further emphasized that Delaware desired a barrier to insure the State an adequate supply of fresh water for the future.

106. Mr. A. H. Underhill, Director, New Jersey Fish and Game Division, in a statement read for him by Mr. George Shanklin, reiterated what had been said about the necessity to understand the complicated factors whose interaction control the ecology of the lower river and bay. He urged that adequate consideration be given to the effect of a salt water barrier on fish and wildlife resources of the area. He also urged that adequate time and funds be made available to the U. S. Fish and Wildlife Service, to the Fish and Game Division and to related agencies to permit proper evaluation of the changes that would be caused by a barrier.

107. Mr. Henry W. Peterson, South Jersey Port Commission, pointed out some of the flood conditions caused by high tides and fluvial flows between Trenton and Wilmington during the August 1955 flood. He urged caution to insure that any locks to be built in a barrier be large enough for future increase in the size of vessels.

108. Dr. Thurlow C. Nelson, Biologist, New Jersey Division of Shell Fisheries, presented an extended discussion of the oyster industry in the Delaware estuary and of some of the factors which affect it. He pointed out that a change in flow conditions, due to a barrier in the estuary, might be harmful to the oysters and only extensive studies could determine in what way and how much. He wanted to make sure this phase of the study was not overlooked.

109. Mr. Wayne D. Heydecker, Secretary-Treasurer, Atlantic States Marine Fisheries Commission, presented resolutions adopted by that organization in September 1958 to the effect that since the effects of a salt water barrier on fishery resources were unknown, that prior to the initiation of construction of such a barrier, ample time be given to the State and Federal conservation agencies to make a comprehensive study of the biological, ecological, and sociological impact of the proposed construction on the fishery resources. He requested that U. S. Fish and Wildlife Service, the Conservation departments of the States, and his Commission be kept fully informed and be given ample time to make necessary studies. He also described some of the efforts that have been made to reestablish shad runs in Delaware River.

110. Mr. J. Alex Crothers, Delaware River Port Authority, in a statement presented by Mr. John Frazier, gave tonnage movements in and out of the Port of Philadelphia, as well as dollar values, and a discussion of the economic influence of the port and transportation on Delaware River on Philadelphia and its vicinity. The statement emphasized that any study of a barrier must be made against this backdrop of the economic value of the present access to world markets and the future growth potential of the Port of Philadelphia.

111. Mr. Clayton Hoff, Executive Vice President, Brandywine Valley Association, called attention to the fact that he felt any study of a barrier must be coordinated with the development of upstream water supply storage since a barrier would not create any new water and only change what is now saline water to fresh water storage.

112. Mr. Walter Phillips, Executive Secretary, Delaware River Basin Advisory Committee, made a few remarks in which he explained the purpose and composition of the Advisory Committee. He stated that the Committee needs to know the answers to a good many technical questions before it can offer any very specific comments or data as to the expected import of a barrier. The Committee would like to see a preliminary study. He also stated that the Committee's interest is in a comprehensive plan for development of the water resources of the Delaware basin and that the barrier study should be included in developing this plan.

113. Mr. Samuel S. Baxter, Water Commissioner, City of Philadelphia, stated that one of the questions to be considered in connection with a barrier is what will be the effect on Philadelphia's water supply. It might cause the city to have to go to upland sources at an earlier date. He also mentioned possible delays in Philadelphia's shipping and port operations; effects on sewers and how the reservoir would affect their discharge as well as their pollution effect on the reservoir. He pointed out that a barrier in addition to providing fresh water for the State of Delaware would also give it an advantage in securing new industries to the economic disadvantage to Pennsylvania and Philadelphia. He also mentioned that diversions from the reservoir might very well generate another United States Supreme Court case to allocate water between the States. He recommended that the study also evaluate other methods of securing fresh water for Delaware, such as aqueducts to the river above tidewater at Trenton and possible conversion of sea water, either of which might prove more economical than building a barrier.

114. Mr. Charles Gillece, Mayor of Burlington, New Jersey, stated that the construction of a barrier would aggravate sanitary and flood problems in Burlington. It would greatly retard flushing of storm drains and reduce their carrying capacity by lowering their hydraulic gradients. In addition, it would: (1) induce silting in Delaware River and Assiscunk Creek and present a serious drainage problem; (2) raise

ground water levels in Burlington and thereby cause basement flooding and increase pipeline construction costs; (3) make maintenance of tide gates difficult since they would always be under water; and (4) increase flood heights and possibly outmode local protection works constructed by the city. Locks required in a barrier might adversely affect the value of industrial property in the City of Burlington.

115. Mr. Francis J. Callahan, Vice Chairman, Gloucester City, New Jersey, Sewerage Authority, stated that the Authority operates the sewage disposal plant for the City of Gloucester and that high tides under present river conditions make it difficult to maintain and operate the sewer system. He expressed concern as to the effects on this system if a barrier were constructed in the estuary.

116. Mr. Albert J. Zamal, Municipal Attorney, Greenwich Township, Gloucester County, New Jersey, called attention to the drainage problems of Greenwich Township, which is largely protected by dikes. He stated that if a barrier produced a pool with its surface at mean high tide, all of the drainage in the township would have to be pumped. He asked consideration of this problem.

117. Mr. Harry J. Schad, Chairman, Joint Executive Committee for Improvement and Development of Philadelphia Port Area, stated that his committee had grave misgivings as to the practicality of a barrier insofar as navigation interests are concerned. It had filed a statement for the record regarding these problems. He stressed that he felt every effort should be made to find alternate means, possibly by aqueducts or conversion of sea water, to supply the State of Delaware with fresh water. He also urged that plans be made to provide fresh water by upstream reservoirs or to divert it from Susquehanna River, for the lower Delaware River area. He stated that his committee felt a barrier would be intolerable insofar as the tremendous amount of traffic, which goes up and down the river, is concerned. He also pointed out the relative size of this traffic movement and a number of the problems that would be encountered if locks must be used for passage through the barrier.

118. Mr. E. M. Keely, Chairman of Port Affairs Committee, Delaware Valley Council, stated that the Council requests the Corps of Engineers to consider the following points: (1) the effect of a salinity barrier on future salinity conditions in the river; (2) the location and cost of a barrier; (3) the effect of a barrier on the regimen of the bay and river, including floods, movement of silt and waterborne debris, and tidal action; (4) the effect on future industrial development; (5) the effect on industrial waterfront structures; (6) the impact on the fishing industry, especially the oyster, in lower Delaware Bay; and (7) the problems created in discharging sewage and industrial wastes. He listed a large number of questions regarding the effect of a barrier which the Committee felt should be answered satisfactorily before a decision was reached. He pledged the wholehearted



cooperation of the Delaware Valley Council in helping collect data, especially on the navigation aspects of the proposal.

119. Mr. Harold J. Winkelspecht, Chairman, Board of Directors of the Delaware River Valley Association, read a letter prepared by his Association. This letter stated that if the purpose of a barrier was to provide fresh water for the State of Delaware, the Association was opposed to it. If a barrier was to prevent further intrusion of salt water up the river, the Association favored it. It also stated that the Association was very conscious of the detrimental effect of any impediment to river traffic that might be caused by a barrier and felt that a careful study should be made of all the aspects of the project.

120. Mr. George Deming, representing the Chamber of Commerce of Greater Philadelphia, stated that the Chamber was concerned with the economic effects of a barrier. He mentioned the cost of lockage of boats through a barrier; the adverse effects expected by the shipyards located along the river above a barrier; and the effects on local industry dependent on water shipment and engaged in production for national defense during wartime if the locks or barrier were destroyed. He urged that every alternative to a barrier be studied, and offered the wholehearted cooperation of the Chamber in the study.

121. Mr. Duncan C. Nevins, Chairman, Port Affairs Committee, Camden County, New Jersey, Chamber of Commerce, stated that the Chamber is opposed to any construction which would create a barrier to obstruct the expansion of the port and/or industry in Camden city and County, which is so dependent on the existing free flow of the river. He suggested that the locks in the barrier would cause costly delays to shipping and would give indirect advantages to the Ports of Baltimore and New York; that their vulnerability in wartime would also greatly reduce the ability of the port and area to contribute to national defense; a barrier would require the shipbuilding industry to bear extra costs to modify its yards and launching facilities; that high costs might be incurred in winter for ice breaking in the reservoir; and that changed river conditions would result in innumerable legal problems.

122. Mr. Barnett Silveston, representing the American Merchant Marine Institute, read a letter prepared by the Institute. The letter supported the statements made by Mr. Harry Schad, Delaware Port Authority, and requested permission to defer further action until a study had been made of plans and details of the proposed barrier.

123. Mr. Howard O. Sturgis, Director, of the Industrial Products Division of the National Fisheries Institute, Inc., Washington, D. C., pointed out that Delaware Bay is responsible to a large extent for the prosperity of certain oceanic fish stocks, and that his Institute feared the construction of a barrier would cause untold possible injury

to migratory fish and shellfish and to such edible fish as the shad and striped bass. These fish, as well as the croaker, spot, blue crab and menhaden, use estuarine waters as nursery grounds, and the closing of the Delaware estuary to this use would reduce their numbers and affect fisheries not only in Delaware Bay but all along the Middle Atlantic Coast. He attached to his statement a copy of resolutions passed by the 13th Annual Convention of the Institute on April 1958, for further consideration. These called for further research programs for determining the complex biotic changes that accompany physical modification of estuarine environment. He urged that a thorough and comprehensive examination of the impact and effect of a barrier on fisheries, wildlife, and wetlands be completed before a barrier is designed or constructed.

124. Mr. George F. Lynn, Director of Public Relations, New York Shipbuilding Corporation, stated that his Corporation feared that construction of a reservoir by a barrier would produce water conditions that would adversely affect its activities. These conditions would consist of adverse currents during launching of vessels; higher levels reducing usable lengths of its shipways; uplift conditions adversely affecting operation of its drydocks; and reduced bridge clearances limiting the size of the vessels it could construct. He urged that some other method be found for supplying fresh water to Delaware.

125. Mr. Carl Mohr, Engineer, Delaware County, Pennsylvania, proposed that a series of low rock wing-dams be constructed in the river and bay by the various County and State Highway Departments to slow down tidal flow and reduce the salt water intrusion in Delaware River.

126. Mr. Davis H. Wallace, Director of the Oyster Institute of North America, stated that the effect of a barrier might change the currents in the Delaware estuary and mean disaster to the oyster fisheries in Delaware Bay which have an annual value of about six million dollars. He urged that this factor be considered in the studies of the barrier.

127. Mr. C. Jackson Simmons, appearing for the Virginia Fisherman's Association, stated that the catching and processing of menhaden fish into commercial products was a multimillion dollar industry. He stated that these fish spawn in the open sea but the young come inside to estuary waters of bays and rivers for nursery grounds and go as far upstream as brackish waters. At the end of one year they return to ocean waters. He stated that the constant diminution of estuarine conditions by destroying the nursery grounds is reducing the abundance of menhaden and affecting the industry. He also stated that the full impact of a barrier on these fish is unknown but urged that the U. S. Fish and Wildlife Service be given sufficient funds to make a thorough study of this fish and the effect of a barrier before it is constructed.

128. Letters, briefs, and memoranda, were submitted by other interests in connection with the hearing, and expressed views as follows:

a. Mr. Ivan McKeever, U. S. Soil Conservation Service, Harrisburg, Pennsylvania, stated, in a letter, that a preliminary consideration of a barrier indicated it would have a very limited effect on agricultural drainage in this area.

b. Mr. Daniel J. Tobin, Regional Director, National Park Service, by letter, stated that it was the opinion of his agency that a barrier would improve the scenic qualities along Delaware River including the tidal sections of the tributary streams by eliminating the mud flats and generally unsightly conditions resulting from tidal action. The fresh water lake created would also appear to be more conducive to recreation activities for boating, fishing and other types of water recreation.

c. Mr. John P. Robin, Chairman, Delaware River Basin Advisory Committee, submitted a statement for the record, in which the Committee strongly recommended the preliminary study of a barrier in the Delaware estuary and its inclusion as a part of the comprehensive survey of the water resources of the Delaware basin.

d. New Jersey Senator John A. Waddington, Salem County, New Jersey, by letter, stated that he felt the study was warranted but must be comprehensive in evaluating not only the feasibility and costs of a barrier but also alternative methods of providing additional large volumes of fresh water and important related problems connected with the project.

e. Mr. Samuel S. Baxter, Water Commissioner, City of Philadelphia, stated in a letter, that the city's position regarding a barrier is that there should be enough study and review made at this time to determine whether a complete detailed study should be undertaken. The letter listed a number of questions which the City felt should be carefully considered in the preliminary study.

f. Mr. Frederic R. Mann, Director of Department of Commerce, City of Philadelphia, by letter, supplemented the letter of Commissioner Baxter and listed an additional number of factors which his department felt must be considered in the preliminary investigation.

g. Mr. C. Marvin Montgomery, Mayor of Burlington, New Jersey, submitted, by letter, a statement of unfavorable conditions which would result in Burlington, New Jersey, from the construction of a barrier, and included the objections of that city to the project.

h. Mr. Lewis M. Myers, Chairman of the Logan Township Committee, by letter, stated that Logan Township, Gloucester County, New Jersey, was opposed to the construction of a barrier since it would inundate large areas of land in Logan Township and would increase serious drainage problems in that township.

i. Mr. H. Gilroy Damon, Engineering Firm of Damon & Foster, Sharon Hill, Pennsylvania, submitted, by letter, engineering data relating to municipal sewage treatment plants, for which his firm is the consultant, and operated by:

Darby Creek Joint Authority  
Muchinipates Authority  
Central Delaware County Authority  
Eddystone Borough  
Tinicum Township

He stated these plants would all be adversely affected by the pool created by a barrier and would require extensive modification in order to be operated.

j. Mr. Willard B. Kille, representing the Southern New Jersey Development Council, by letter, emphasized the acuteness of land drainage problems along Delaware River in southern New Jersey and urged that these be considered in the barrier study.

k. Mr. J. Huber Denn, Industrial Commissioner, Delaware State Chamber of Commerce, submitted a statement showing that New Castle County, Delaware was expected to have a very large population and industrial expansion, and by the year 2010 the water demand of the County would be about 600 million gallons per day, while only about half of this would be available from local sources. He suggested studies to determine the location for a barrier so as to not interfere with a proposed additional channel in the vicinity of New Castle, Delaware.

l. Mr. Kilshaw M. Irwin, Vice President, Philadelphia Electric Company, presented a statement to the effect that his company was concerned as to the effect of the pool that would be created by a barrier on uplift and cooling water problems at the plants of his company located along Delaware and Schuylkill Rivers.

m. Mr. Lloyd R. Leslie, Vice President, Delaware Power & Light Company, by letter, pointed out that his company is a large user of cooling water from Delaware River. He recommended a thorough study of the barrier proposal.



n. Mr. A. P. Norton, Plant Manager, Continental Can Company, Wilmington, Delaware, stated, in a letter, that his company would oppose the construction of a barrier if it would in any way increase maritime freight rates that his company might have to pay on its imports of foreign materials.

o. Mr. J. C. Kall, Vice President, Keystone Shipping Company, Philadelphia, Pennsylvania, in a copy of a letter to the Philadelphia Maritime Exchange, stated that it was the opinion of his company that a barrier would serve no good purpose to ships and shipping, nor to the expansion of the Port of Philadelphia. He contended that it would increase hazards to navigation, slow down river traffic, and subject vessels to extensive delays while awaiting transit through locks. It would also increase dangers of collision of vessels due to bunching of traffic, and would increase costs to vessels serving the area.

p. Mr. Henry P. Megaryl, Jr., Attorney for Atlantic City Electric Company, submitted a statement pointing out that the company had two major steam electric plants on Delaware River above the proposed barrier site, and that this development would possibly subject them to inundation by raising the river level, create drainage problems at these plants, and require radical alteration of their cooling water systems. He pointed out that the company would be interested in an improved source of fresh water for its plants and believed that a highway and a railroad should be constructed across the barrier to aid transportation.

q. Mr. Stewart Huston, Vice President of Lukens Steel Company, Coatesville, Pennsylvania, by letter, asked a number of questions regarding the barrier proposal and suggested that alternate means of securing fresh water supplies by storage dams upstream might result in the greatest use of the Delaware basin water resources.

r. Mr. Seth D. Folk, Secretary for the Berks Boating Club, Reading, Pennsylvania, stated, in a letter, that the club feels that all navigable waters such as the Delaware should be kept free and open to both commercial and recreational users; that a barrier would destroy the natural waterway by imposing undue and unnatural delays, and would cause higher tide levels downstream that would flood land and create problems in the passage of water through the Chesapeake and Delaware Canal.

VIII PUBLIC HEARING AT PHILLIPSBURG, NEW JERSEY -  
13 APRIL 1960

129. This public hearing was held as the first in a series of four subsequent to the development of a plan of improvement for the Delaware River basin. The purpose of the hearing was to present the main features of the plan of improvement developed by the District Engineer, and to obtain the reactions and views thereto of various interests, organizations and individuals.

130. Colonel T. H. Setliffe, District Engineer, U. S. Army Engineer District, Philadelphia, conducted the hearing in the auditorium of the Phillipsburg High School, Phillipsburg, New Jersey. He reviewed the fact that authority for the survey, report and hearings were certain resolutions adopted by the United States Senate and by the United States House of Representatives. He also cited the fact that earlier hearings were held, at the beginning of the survey to obtain views concerning the need, advisability, character and extent of improvements desired. He stated the purpose of the present hearing as mentioned above and outlined the procedure to be followed after the completion of the survey report and hearings. After appropriate review and incorporation of any changes found necessary the report would be submitted by the Chief of Engineers to Congress. He emphasized, however, that completion of the report, hearings and subsequent discussions did not obligate the Government to adopt any project, and that construction was contingent on appropriations. He stated that most of the information in his presentation was contained in the Information Bulletin, "Delaware River Basin Study" previously distributed. The following portion of the presentation was augmented by slides containing photographs, outlines and charts. The talk was in five parts. The first part covered the origin of the study; the job organization; who participated in the work; and the assignment of specific tasks. The second part covered the projected growth of the Delaware basin and its relation to water resources. The third part covered the needs of the basin as determined by the various agencies. The fourth part covered the tentative water control plan under consideration and a logical sequence for its development. The fifth part showed how the plan satisfies various needs. Details are contained in the official transcript of proceedings on file in the Philadelphia District. The plan of development described by Colonel Setliffe included 11 major water control projects with provisions for water supply, flood control, power and recreation. Eight other sites had been selected for partial development - their initial development being for recreation - with use for water supply when needed. There are also 39 projects which had been selected for sub-basin development, all with the main purpose of flood control. All but three of

of these dams can be authorized for construction under Public Laws 685 and 566. In addition, seven unique and historical sites had been selected for further recreational development. It was pointed out that the cost of providing flood control works is the responsibility of the Federal government, while works for water supply are the responsibility of state and local interests. Recreation facilities may be provided by the Federal government if the benefits have wide regional significance, otherwise they become the responsibility of state or local interests. Alleviation of flood problems in the uppermost headwater areas of the basin would be provided by land treatment measures under existing programs of the Department of Agriculture. The estimated reduction in annual flood damages in various reaches was discussed and recreation benefits were considered. The production of about 385 million kw-hr of hydroelectric power annually at two of the major control projects was found to be feasible. The matter of how to accomplish the program encompassed by the plan of development was raised by Colonel Setliffe. He mentioned that this was the subject of a detailed study by the Maxwell Graduate School of Public Administration of Syracuse University. On 30 September 1959, the Water Research Foundation presented to the Governors and Mayors, at a meeting in Philadelphia, the main Syracuse report. An abbreviated version was made public on 21 September 1959, entitled, "A Brief Report on the Study of Governmental Organization for the Water Resources of the Delaware River Basin by the Maxwell Graduate School of Syracuse University". The Syracuse report is being acted on by representatives of the four Governors and the Mayors of Philadelphia and New York City in their effort to arrive at legal agreements or a compact that will permit them to establish a basin control organization. After presentation of the plan of development Colonel Setliffe called on representatives of the Federal government, State, county and local governments, associations, companies and individuals, in that order, for their comments. A digest of the comments follows.

131. Mrs. Helen D. Sutton, representing Congressman Francis E. Walter of the 15th Congressional District, Pennsylvania, submitted a statement. This statement reviewed the fact that Congressman Walter's resolution to provide funds for the survey and report was adopted by Congress with a minimum of opposition, thereby establishing the meritorious nature of the contemplated improvements. It mentioned that the 308 report, reviews thereof and work relief projects provided much information for the preparation of an adequate program. The statement recommended that the respective heads of the agencies of the affected states make immediate preparation to submit plans to their respective legislatures so that compacts may be entered into promptly. When such compacts are submitted to Congress for approval and referred to Congressman Walter's committee he promised to make every effort to have the compact approved promptly. The importance of dams in the alleviation of flood damages,

reduction in river dredging costs, and provision of water to satisfy growing demands therefore was emphasized. The Congressman's statement also emphasized that the conversation phase of the plan should be curtailed as much as possible and that legislative approval and appropriations were in order.

132. Honorable George S. Smith, Mayor of Easton, Pennsylvania, expressed the hope that the dams would be built before another disastrous flood occurred, and that the plan would not linger too long in legislative halls.

133. Mr. Howard B. Allen, Vice President, New Jersey Power and Light Company, submitted written statements for the record signifying that his company and affiliate, the Jersey Central Power and Light Company, together with the Public Service Electric & Gas Company were prepared to take over whatever hydroelectric output there is in connection with the Tocks Island project. These companies, through interconnected distribution systems, supply about 90% of the electric energy consumed in New Jersey. The statement specifically expressed the concurrence of the electric company with the views expressed in the March 1960 Information Bulletin of the Corps of Engineers relative to the basin program. It also expressed the desire to cooperate and participate in the plan of development in general and in the following three particular ways: (1) The New Jersey Power and Light Company would undertake at its expense the Tocks Island pumped-storage project. This would include (a) construction of high level dams and reservoirs atop Kittatinny Mountain, (b) a powerplant site and facilities adjacent to Tocks Island dam, and (c) connecting waterway facilities. The Company would also operate the electric facilities and reimburse the owners of the Tocks Island reservoir for the allocable portion of the investment originally made in providing the reservoir; (2) the Company would also agree to utilize without charge except for replacement energy its Tocks Island pumped-storage project facilities for the transfer from the Delaware River of a quantity of water not in excess of 150 M.G.D. to be used for public potable water supply; (3) the Company would also cooperate in the development program by constructing at its expense the on-stream hydroelectric plant recommended by the Corps of Engineers or operate such plant under appropriate arrangements with the owner of the Tocks Island dam facilities and provide facilities for marketing the output. Details of the Tocks Island pumped-storage project had been discussed previously with New Jersey Department of Conservation and Economic Development, New Jersey Department of Public Utilities, Delaware River Basin Advisory Committee, Delaware River Water Resources Association, and the Power Work Group assisting the Corps of Engineers. No adverse reaction was voiced by representatives of the agencies, most of whom assisted in development of the project.



134. Mr. M. D. Hooven, Consulting Engineer, Public Service Electric and Gas Company, submitted a written statement for that company expressing willingness to participate with the New Jersey Power & Light Company in the project which has to do with power development at the Tocks Island location.

135. Mr. Thomas Mullen, Jr., Malone Metal Powders Company, Flemington, New Jersey, asked about the connection between the proposed project (Tocks Island implied) and the Round Valley reservoir plan in White House at Linden, New Jersey. Mr. Russell Morgan, (Corps of Engineers) replied that the State of New Jersey has the right to divert to their Round Valley project or elsewhere one hundred million gallons of water a day from the Delaware River, and that 150 million more would be available but diversion facilities were not in the plan.

136. Mr. J. Gordon Cree, Manager of Utilities, Borough of Chambersburg, Pa. and Director of the Pennsylvania Municipal Utilities Association, raised the question of public power versus private power and was assured by Colonel Setliffe that the matter would be handled according to law and would not go by default.

137. Mr. Malcolm P. Crooks, Stony Brook-Millstone Watershed Association, New Jersey, asked if and when there would be an opportunity for public discussion and analysis of particular reservoirs, site by site, before reservoirs are actually built. Colonel Setliffe assured him that the public would certainly have that opportunity, project by project, and that the main intent now was in the overall plan and how individual projects would fit into it.

138. Mr. John Chaplinsky, Chairman of the Aquashicola Fact-Finding Committee, stated that they have polled nearly 200 residents concerning the proposed Aquashicola dam and all but five were opposed to it. Results of the poll were to be submitted by letter for the record.

139. Mr. James Lawrence, Trenton Times, asked when the report would get to Congress. Colonel Setliffe stated that an exact timetable could not be given for several reasons involving review and comments, and that it would not get to the present Congress, but might get to the next one.

140. Mr. Robert A. Harrier, Director, Lehigh Valley Flood Control Council, asked whether information was available on allocation of water storage in various reservoirs and allocations of costs assigned to the different functions. Colonel Setliffe stated that such information was among the last things that could

developed for a report like this, and that it was now being developed and would go out to the Federal and state agencies for review within the next few months.

141. Mr. George C. Pfeiff, Raritan Council, Boy Scouts of America, asked how soon, and through what agency, specific information would be available on water elevations, road alignments, etc. above reservoirs, particularly with regard to the Tocks Island project. Colonel Setliffe stated that at Tocks Island flow level would be at elevation 423 and under normal operations at approximately elevation 404.

142. Mr. Franklin Taylor, Member, Aquashicola Committee, asked whether specific questions on the Aquashicola dam site could be answered. Mr. Morgan stated that a request from the Committee for data on that project had come to the District Office, and Colonel Setliffe said that it would be answered.

143. Dr. Maurice K. Goddard, Secretary of Department of Forests & Waters, Pennsylvania, explained that the Aquashicola Committee had wanted a meeting before this Phillipsburg meeting but it was thought best to defer the meeting until after the hearing at Reading on April 20, 1960. Colonel Setliffe asked for any other questions and, getting none, closed the hearing.

IX PUBLIC HEARING AT READING, PENNSYLVANIA  
20 APRIL 1960

144. Colonel T. H. Setliffe, District Engineer, conducted the hearing in the Metropolitan Edison Company Building, Reading, Pennsylvania, on 20 April 1960. His presentation covered the same material presented in the same manner with Vugraph slides, etc., as summarized for the public hearing at Phillipsburg, New Jersey, held 13 April 1960. After presentation of the plan of development Colonel Setliffe called for comments which are briefed in the following paragraphs.

145. Senator Frank W. Ruth, Pennsylvania Legislature, asked two questions; first, who pays for property damage, and second, whether the job could not be done with a series of smaller dams where properties would not be destroyed and the same amount of water could be accumulated. Colonel Setliffe stated that property damage was handled according to law and that local or state cooperation on Federal projects usually includes furnishing land, easements, and rights-of-way. On purely flood control projects there may be some variation and the cost may be paid by the Federal government. Holding and saving the U. S. government free of damages, and the maintenance of certain projects are also matters of local interest. Dr. M. K. Goddard, (Secretary of Department of Forests & Waters, Pennsylvania) supplemented Colonel Setliffe's answer by citing the example of Prompton reservoir. In this case the Corps of Engineers is buying the land for the permanent pool and the Commonwealth of Pennsylvania is acquiring the peripheral area for development of a state park. The second question was answered by Colonel Setliffe as being purely a matter of economics. He cited the example of Tulpehocken Creek when the cost per unit of storage for a number of small dams and reservoir amounted to \$368.00 as compared to \$192.00 per unit of storage for a large dam and reservoir.

146. Mr. James F. Haldeman, County Agent, Agricultural Extension Service, asked how the hydroelectric power would be handled. Colonel Setliffe mentioned the statements and proposals made by the representatives of power companies at the Phillipsburg, New Jersey hearing whereby the power produced would be sold to the user through existing private concerns, and thus the cost of the power share of the project would be repaid to the Federal treasury so that the tax dollar would not support the power features of the project.

147. Dr. M. K. Goddard, Department of Forests and Waters, Pennsylvania, said he had been asked why the Aquashicola project was shown for completion in 1981, Beltzville in 1985 (sic) and Bear Creek not until 1989. With Bear Creek now in its fifth year of construction, why not complete its addition before Aquashicola and Beltzville are initiated. In reply Colonel Setliffe explained the

need for a balanced program through the consideration of the four basic items - flood control, water supply, recreation and power. Bear Creek expansion would be purely for water supply whereas Beltzville and Aquashicola also provide flood control and recreation. Dr. Goddard asked if the low annual damage (\$144,000) listed for the Lackawaxen River was based on Prompton dam in operation. Colonel Setliffe stated that the figure was based on both Prompton and Jadwin (formerly Dyberry) dams being in operation, although the Prompton project was not quite finished.

148. Mr. Richard Byler, Technical Director, Montgomery County, Pennsylvania, asked how the plan met the present need for water in communities such as Lansdale, Pennsylvania. Mr. Morgan replied that the planning was based on water needs that cover everybody in the basin on a broad scale. There is enough water and the special problem areas such as Lansdale have been recognized. Distribution of the water from an available source to the ultimate consumer is a basic problem and it is one for the local people to resolve. Colonel Setliffe emphasized that the problem in planning was to make certain that water is available to meet the needs on a total basin requirement basis. Mr. Byler also asked about preservation of project sites, particularly in rapidly expanding areas. Colonel Setliffe replied that the matter of reserving lands for future use is recognized by the Senate Committee on Water Resources. The report will include recommendations that reservation of sites be one of the actions considered at the Federal and at the local levels. The need for additional legislation is also recognized.

149. Mr. A. Killian asked why a project site was changed from Bernville to Blue Marsh. Mr. Morgan replied that it was better to shift to a lower site (Blue Marsh), which was considered in an earlier stage of the studies, to avoid the economic impact on Bernville. Mr. Killian raised the question of drainage which he thought was more favorable for the Bernville site than at Blue Marsh. Mr. Morgan said that had been considered and the Blue Marsh site would hold water. Colonel Setliffe stated that 576 possible sites had been analyzed from many points of view, about 176 had been eliminated for various reasons. Detailed questions on the Bernville-Blue Marsh change would be considered later, if desired, but the decision was reached on an economic basis. Mr. Killian also asked how the valuation of property would be determined. Colonel Setliffe stated that it would be based on the valuations established by three qualified, licensed appraisers chosen from the area in which the project was located. If the owner will not sell at the fair appraised value, the matter must go to the courts, in accordance with the laws governing such matters.



150. Mrs. Emma Forrey Mullen, Assistant County Solicitor, Berks County, Pennsylvania, speaking for Mr. Carl Schatz, Jr., stated that one-fourth of the land, valuable farming land, of Lower Heidelberg Township, was being taken for one of the projects and there would be a tax loss. She asked whether there was not a better location for the dam. Colonel Setliffe replied that if there had been one, it would have been chosen.

151. Mr. David Batdorf, Solicitor, Bernville, Pennsylvania, asked if the area of condemnation would exceed at any time the spillway elevation for the Blue Marsh project. Any extra condemnation would go through the main street of Bernville. Colonel Setliffe stated that the spillway elevation would be exceeded, possibly by five feet. The final design elevation, however, may deviate somewhat from the present initial planning stage.

152. Mr. William H. Givin, Supervisor, South Coventry Township, asked if an estimate had been made on property damage for the French Creek dam site. Colonel Setliffe stated that it was included in the economic analysis. Mr. Givin also asked when the French Creek dam might be started. Colonel Setliffe replied that the dates when certain projects would be needed had been announced, and that it was usually five to ten years after the local people got Congress to authorize construction.

153. Mr. Joseph E. Dempsey, Zoning Officer, West Vicent Township, raised the question that no "date needed" was given for the French Creek project. Colonel Setliffe said that French Creek fell into the category of dams to be developed initially for recreation, prior to 2010, and sometime thereafter for water supply.

154. Mr. Kenneth R. Good, Principal, Penn-Bernville School District, asked if there would be consultation with local authorities in the planning for the taking of land to five feet above the spillway elevation (for Blue Marsh) which would come close to their school area. Colonel Setliffe stated that the elevation of the final pool will be determined by engineering requirements and will not be a matter of local consultation. He quoted from a letter from Dr. Goddard to the Stroudsburg Daily Record to the effect that there are always economic side effects to any large-scale public project, that people in proposed project areas should go on living as if the project had never been proposed, and that acquisition reimbursements would be fair. He stated that the most good for the most people for the least cost was the main consideration. Dr. Goddard emphasized that the government tried to be fair and no one would take land without hearing, consultation and fair appraisal.

155. Mrs. Mary Archer, Pennsylvania Farm Bureau, made some statements regarding her familiarity with the area in the general vicinity of Reading. She asked where the water comes from, and if the waters of the Tulpehocken and Maiden Creeks were impounded where would the water flow - into the Schuylkill Valley or the Delaware Valley? Colonel Setliffe asked if she would restate her questions specifically after the meeting and they would be referred to state agencies for reply.

156. Mrs. C. A. Wade spoke for Mrs. Robert N. Potts, Jr., and other home owners along French Creek. She asked whether the French Creek project was considered economically feasible by the U. S. Army Engineers. Colonel Setliffe answered that if it did not have a benefit-cost ratio greater than one it would not be on the list, and that it was economically feasible. She wanted to know if it was mainly for recreation. Colonel Setliffe stated that it was initially for recreation but ultimately would include water supply when the needs developed. Mrs. Wade said there was water supply up French Creek now at Hopewell and if their land would be tied up until 2010 wouldn't that be unfair to the landowners? She also stated that they were in the middle of a building program for seven school districts. This includes a recently constructed high school at Bucktown, right above the proposed dam site. She raised the question of assessments and increased costs to remaining land owners when project land would be taken off the tax list. Colonel Setliffe stated that it certainly was a matter for economic consideration which would be considered in economic evaluation on the basis of need for replacement or reimbursement. Mrs. Wade asked for exact map location of the dam (French Creek) and was referred to two maps on exhibition at the meeting. Colonel Setliffe stated that exact elevations would not be known until project authorization and final engineering studies were made, but that (proposed) water elevations could be given. Depreciation was mentioned by an unrecognized voice from the audience. Mrs. Wade also questioned the recreation value of the project as compared to her estimate of present recreation values along French Creek.

157. Mr. W. J. Strachan, Virginville, Pa., asked about the comparison of costs of water under the plan of development vs. desalting sea water. Colonel Setliffe replied, in effect, that desalting costs by presently known methods would be very much greater. He also assured Mr. Strachan that land acquisition and all other costs were included in the estimated cost of the proposed plan.

158. Mr. J. C. Gilardone, Jr., Virginville, Pa., suggested that the reason for abandoning the Bernville dam site was because of opposition. He acknowledged the need for water but questioned the need for taking "five to ten times as much land around it."

Colonel Setliffe restated that this was not an examination - cross-examination presentation; that an engineering analysis had been made based on costs and benefits and that the Corps of Engineers was not playing at politics. He stated that the final action to be taken on the proposed plan was not a matter for field offices of the Corps of Engineers to decide.

159. Mr. W. G. Kerchner, Lenhartsville, Pa., questioned the high cost of financing the projects when the Federal debt and taxes were already high and said he was against planning ahead 50 years and putting the cost on the children. Colonel Setliffe replied that keeping the country solvent was the responsibility of the President and the Congress.

160. Mr. Robert R. Glassmire, RD 1, Robesonia, Pa., who owns land along Tulpehocken Creek asked if a private citizen would be allowed to own land down to the water's edge, or would it be "confiscated" or bought. Colonel Setliffe stated that the plan at present did not cover how much land in the Tulpehocken recreation area would become state land, but that there would be restricted areas involved. Mr. C. H. McConnel, Pennsylvania Department of Forests and Waters, added that for projects being built today, land for recreation around the periphery of the reservoir is normally acquired by the Commonwealth. Mr. Glassmire asked if it was true that the Tulpehocken dam would not be started until after Congress had appropriated the funds for it. He was assured that it was true, plus the fact that the report itself must go through review channels and meet the approval of Congress.

161. Mr. Clarence K. Geise, Sinking Springs, Pa., raised several questions relative to saleability of properties, basis of payment, inflation problems, how far back from the water the land purchase line would be, when the money would be available to purchase properties, where the money was coming from, loss of productive farm land, loss of tax revenue, water quality in the Blue Marsh area vs. higher up in the mountains, and loss of esthetic values. Colonel Setliffe stated, in effect, that availability of money for land purchase and tax adjustment was a matter of consideration between the State and the township; and that other questions had been answered as best they could according to present knowledge, and any further specific questions would be considered. When certain things would be done could not be answered at the present time.

162. In answer to a note from the audience, Colonel Setliffe defined water supply storage as storage usually full to an elevation indicated, whereas flood control storage is usually empty except when there is a flood.

163. Mr. Henry J. Schlegel, Wernersville, Pa., asked whether the 4,200 acres announced in the newspaper to be impounded by the Blue Marsh project included water-cover ground only or also recreational area. Colonel Setliffe stated that about 4,000 acres were required for the entire project. He also stated that questions about specific properties would be answered if addressed to the District Engineer at Philadelphia giving actual location and elevation.

164. Mrs. Frank X. Boulanger, State Hill Road, Sinking Springs, Pa., asked if she should go ahead with tree planting on her property in the Blue Marsh project area and where the water line would come on her property. Colonel Setliffe said he could not advise her to start or stop, since he could not tell if or when the project might be built. He also asked her to send him the exact location and elevation of her property for answer about water line.

165. Mr. Robert E. Schultz, Reading, Pa., asked if any other locations like Bernville and Blue Marsh had been changed after local hearings. Colonel Setliffe stated that a number of hearings and re-hearings had been held and that a number of changes had been made from the original 576 sites - that it was a process of elimination. Mr. Schultz also asked why the Blue Marsh project was set up among the first to be done when most of the trouble (flood damages) was elsewhere on the Delaware River. Colonel Setliffe explained that Tulpehocken Creek was a tributary to the Delaware River and that the plan of development considered the entire Delaware River including all of its tributaries.

166. Mr. Robert O. Steiger, Leesport, Pa., stated that his questions had been answered. He expressed the opinion that they (those present) were considering the dollar sign now rather than the future need for water, and that they should consider the dams as supplying the water when they would need it.

167. Mr. John C. Essig, Sinking Springs, Pa., asked if the mayors of cities were taking measures to train the people to conserve water. Colonel Setliffe stated that the Corps of Engineers is not responsible for conservation per se. Other agencies such as Pennsylvania Department of Forests & Waters, the U. S. Department of Agriculture, Soil Conservation Service, and other experts more directly concerned with conservation assisted in development of appendices for the report. The public information program of the Corps of Engineers tries to get information to all people, including the mayors of cities.



168. Mr. LeRoy J. Kline, President, Lion's Club, Bernville, Pa., stated that the Lion's Club held a public meeting last year to clarify the Bernville dam situation for the people of Bernville. He said that he was not conscious of any great pressuring to get the dam away from Bernville. The people would still like to know whether flood waters would come into Bernville so property values and possible required movement (of families and business) would be known. Colonel Setliffe agreed with the need to know but said he didn't know either.

169. Mrs. C. A. Wade, suggested to the people present that they write to their Congressmen and work through other politicians to make their protests effective.

170. An unidentified voice asked how the French Creek and Hopewell areas would be affected, and if additional land purchase was contemplated. Mr. George H. Thompson, National Park Service, answered that the French Creek State Park and Hopewell Village National Historical Site within the State Park were several miles away from the French Creek dam site and would not be affected by the latter project.

171. Mr. Clarence K. Geise, Sinking Springs, Pa., asked if the line drawn across Faydel was a safe line to consider in buying property. Colonel Setliffe stated that the line was good to outline the area affected by water so far as known now, but the actual taking line could not be defined at present. Mr. Geise also expressed the opinion that questions were being asked but were not being answered.

172. Mrs. Carl Werner, Church Road, Wernersville, Pa., stated that property owners were concerned about the amounts paid for homes by the State for highway projects. She said that Berks County had a 35 percent valuation and that in the case of highway route 22, state appraisal for payoff was 25 percent more than assessed valuation, or 60 percent total payoff.

173. In answer to a question from an unidentified person in the audience, Colonel Setliffe stated that land for the Bear Creek dam was acquired by a Federal agency and that land on the Trexler project would also probably be acquired by the Federal government or jointly by the Federal and State governments.

174. Mr. Albert LaSalvia, Collegeville, Pa., asked what could be done to give a property owner protection against devaluation when it became known that his property was within a dam site. Colonel Setliffe replied that that was still a matter for the Federal and State legislatures to consider. It would have to be in the form of authorities, under laws not yet passed, that

would allow the earliest possible acquisition of an approved site. Colonel Setliffe pointed out again that appraisals are made by locally appointed appraisers who certainly would investigate all the background concerning the sites which are under consideration. Only if the appraiser, the government and the owner cannot get together is court action necessary. Court action is rarely necessary. When a project is going to be built is the critical factor which cannot be determined now because of the lack of legal authority and funds to do the job.

175. An unidentified voice asked if some of the other agencies present might be able to say just what the plans are for the dams, specifically: is there going to be an area condemned around them; how far back is it going to be condemned; will people be allowed to live within a certain distance of the edge of the lake; and will people be allowed to withdraw water from the lakes for irrigation. Mr. McConnell, Pennsylvania Department of Forests & Waters, stated that his department could not give specific answers now because much planning still remains to be done, the projects are not authorized projects, and no funds are presently available for the state to buy land for the projects. Colonel Setliffe also emphasized that definite answers could not be given because of a lot of things which are not now known about particular sites, plus the fact that the plans and final designs are not authorized by Congress. Requests in writing for information on specific locations and elevations would be answered in writing insofar as possible. Mr. McConnell mentioned that odd shaped parcels of land were often purchased in their entirety rather than leave the owner with a piece of land which might be undesirable. Colonel Setliffe stated that the amount of land that is taken around any given site depends on the total recreational demand, so every project site would need to be considered separately - it was not possible to generalize.

176. An unidentified voice asked whether the State and Federal governments made settlement for property at the same time. Colonel Setliffe explained that it would likely be a coordinated settlement which would probably be in cash rather than relocation.

177. An unidentified voice asked if the water level will be "Federal" and the recreation will be "state". Colonel Setliffe answered that there is an answer for each site and each location around that site. If a wide area is affected by the recreation features of a project, the Federal government may participate in the recreation aspect. If effects are primarily local, participation would be local.

178. An unidentified voice asked what became of the houses on properties that are acquired. Colonel Setliffe answered that they would be demolished to get them out of the storage zone. Bids are normally taken on salvagable items which are then removed by the highest bidder.

179. An unidentified voice asked how much notification time people would get before having to get out of a project area. Colonel Setliffe answered that he could give only a generalized answer, but that the State and Federal governments were quite cognizant of the public relations aspect of the problem. There is a schedule on such matters but nothing could be done about appraisal until the money was authorized for a project. Then construction usually did not start for a year-and-a-half to two years. Completion of a project usually took three to five years, and a certain amount of money was funded according to need and justification each year.

180. Mrs. Virginia Glassmire, Robeson, Pa., asked if any agency helped in relocation of dislocated people. Colonel Setliffe stated he did not know of any specific Federal relocation organization for such purpose. Normal information is available through existing agencies but no one stands by to say, "Now I'll help you find another home".

181. An unidentified voice asked if there was any reason why some of the dam sites were not picked for the Schuylkill River or the Perkiomen Creek. Colonel Setliffe stated that sites had been considered and selection was based on economic justification and need.

182. Mr. James F. Haldeman, County Agent, asked who determines the use of water below dam sites and would the water be available for any small community. Colonel Setliffe stated that riparian rights are primarily a matter for the state, generally based on Federal aspects. Use of irrigation water would also be covered by state regulations.

183. An unidentified voice asked for an explanation of the wide line, inside the green, on the Blue Marsh map. Colonel Setliffe said the darker one represented an initial development stage and the lighter one the ultimate plan of development. The lighter line indicated flood stage. The green line does not always answer the question because the ultimate size of the recreation area is not known.

184. Mr. A. Killian, asked if the dams would be adequate for water supply and flood control 50 years from now or would other sources be necessary then. Colonel Setliffe stated that the water requirements were based on projections of population and industry up to year 2010.

185. An unidentified voice asked "If you don't have the answer, why do you hold the meeting?". Colonel Setliffe stated that the meeting was held to tell as much as is known about the subject, to present those things that cannot be answered at present, and to get the public reaction to the plans as a matter of record. The uncertainty of some parts of the subject was acknowledged along with the confusion caused thereby.

186. An unidentified voice asked why all the other men were present - that he thought they were present to explain things on (the local) location. Colonel Setliffe explained that they were men who had been working with the Corps of Engineers as members of the Coordinating Committee helping to develop basic information for the plan. They were free to speak if he did not give the right answers or to assist in answering specific questions in their special fields of responsibility.

187. A question was asked about the proper procedures to get additional specific information about any particular property. Colonel Setliffe stated that questions should be addressed to him at his office, giving the exact location and elevation of the property.

188. An unidentified voice asked why the particular dam at Blue Marsh gets precedence over all the others - especially since Tulpehocken Creek is a comparatively small stream. Colonel Setliffe stated that he would be unable to answer the question to the questioner's satisfaction but that it was on the basis of need, benefit-cost ratio, and the least harm for the most good. After the engineering, the rest depends on Congress. With no additional questions, the meeting ended.



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ARMY ENGINEER DISTRICT PHILADELPHIA PA  
REPORT ON THE COMPREHENSIVE SURVEY OF THE WATER RESOURCES OF TH--ETC(U)  
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X PUBLIC HEARING AT WILMINGTON, DELAWARE  
27 APRIL 1960

189. Colonel T. H. Setliffe, District Engineer, conducted the hearing in the Nemours Building, Wilmington, Delaware, on 27 April 1960. His presentation covered the same material presented in the same manner with Vugraph slides, etc., as summarized for the public hearing at Phillipsburg, New Jersey, held 13 April 1960. After presentation of the plan of development Colonel Setliffe called for comments which are briefed in the following paragraphs.

190. Mr. Carl N. Shuster, Director of Marine Laboratories, University of Delaware, Newark, Delaware, raised several profound questions concerning consideration of adequate food production, especially from Delaware Bay and the tidal marshes. He expressed a need for more engineering environmental study than has been given. He also expressed a concern about the problem of radioactive waste discharge in relation to the entire project. He presented four written items to supplement his verbal discourse. They are on file in the office of the District Engineer, Philadelphia, and cover the subjects, "A Biological Evaluation of the Delaware River Estuary", "Estuarine Bulletin", "Where Does the Shoreline Begin?" and a chart entitled "A Model of the Circulation of Phosphorus in a Watershed Including Coastal Offshore Area".

191. Mr. Donald K. Harmeson, State Sanitary Engineer, Dover, Delaware, asked if the plan included specific recommendations for upstream storage of Delaware River water to augment the needs of Delaware for the year 2010. Colonel Setliffe stated that the possibility of a pipeline to extend from the vicinity of Philadelphia and another from a point upstream of Philadelphia had been considered in addition to the proposed Newark and Christiana reservoirs. He stated that the matter of water supply is not currently within the Federal purview.

192. Mr. Jay Harmic, Chief, Delaware Fish and Game Commission, asked about the possibility of maintaining a shad run by release of additional water for low flow augmentation during the month of October, to help the small shad get back down the river. Mr. Russell Morgan, Chief of the Valley Report Group, Philadelphia District, Corps of Engineers, stated that studies had been made and it would be feasible to provide low flow augmentation to the extent of 10,000 cfs flow 3 years out of 4, for about a month's duration in the fall. Mr. Spinner, Fish & Wildlife Service, stated that the matter would be covered further in the appendix on fish and wildlife resources.

193. Mr. H. L. Jacobs, Delaware Water Pollution Committee, pointed out that because the lower part of Delaware River is a tidal estuary, there may be detrimental effects from increased stream flows. He also called attention to the possible high costs to the State of Delaware for having to go to the upper Delaware for water due to increased pollution of the lower reaches on Delaware River. He then asked if there was any way Delaware could receive offsetting benefits to average out the possible detrimental action caused by low flow augmentation. Colonel Setliffe stated that he was not qualified to comment on what Delaware is or is not due legally, that water needs had been defined and means to meet the needs had been suggested, including two dams in the Delaware area. He also stated that he did not know of any laws under which the State could be reimbursed for its water supply actions. He also stated that the State of Delaware was represented during the planning and that its interests were guarded most jealously; that low flow augmentation is usually beneficial; and that some changes in Federal laws pertinent to low flow augmentation and recreation were being considered by the Senate Committee on Water Resources under Senator Kerr.

194. Dr. Maurice K. Goddard, Secretary, Pennsylvania Department of Forests & Waters, stated that his Department had assisted the Soil Conservation Service and the Brandywine Watershed Association (including Delaware members) in a study of Brandywine Creek, but that they were not trying to impose anything on Delaware. Dr. Goddard implied that the reservoirs in the Brandywine Plan would be beneficial to the State of Delaware, and stated that if they could not be built as visualized, Delaware would have to go elsewhere to get the water and that would be a more difficult matter.

195. Mr. John Cahalan, Asst. County Engineer, New Castle County, Delaware, asked how much flow augmentation in Brandywine Creek was considered. Mr. Clayton Hoff, Brandywine Valley Association, answered that the low flow augmentation would be approximately 40 million gallons per day, varying with methods used and drought periods considered.

196. Dr. A. Joel Kaplovsky, Director, Water Pollution Commission, State of Delaware, asked several inter-related questions: (1) Is planning for the Brandywine project (by the Pennsylvania Department of Forests & Waters) identical with planning by the Corps of Engineers?; (2) Is the release planned a guaranteed release or is it going to be waters that are used?; (3) If the waters are not used, is there still a minimum guaranteed flow? Mr. Russell Morgan answered that the Corps of Engineers' planning was on a guaranteed flow basis and that planning in the Brandywine has been on a frequency basis wherein a certain flow is guaranteed

to meet a certain frequency level of drought. Although there is a difference in procedures, the final answers are not too far apart, 40 million gallons per day (mgd) for the method used by the Department of Forests and Waters, and 30 mgd for the Corps of Engineers' method.

197. Mr. Robert Struble, Red Clay Valley Association, asked if the possibility of any more water storage on the Red Clay Watershed had been considered. Colonel Setliffe stated that it had been considered, and was not adopted for economic reasons; he added, however, that what was not economical today may be economical in the future due to changed conditions. At present, the Newark and Christiana projects are the only two projects being recommended in the area.

198. Mr. Stewart Allmond, RD2, Newark, Delaware, a property owner in a dam site area asked when the dams would be built. Colonel Setliffe stated that the dates the projects would be needed had been stated, (1978 for Newark and 1980 for Christiana) and explained the complexities and impossibility of giving firm dates for starting or completing any dam.

199. Mr. Thomas C. Beach, RD1, Landenberg, Delaware, asked if all the area within the green lines on the maps is to be purchased. Colonel Setliffe said that the area within the lines was the extent of possible purchase. Mr. Beach asked if the 156-foot elevation shown for the Newark dam site would "stand" in time of flood and if the Newark project would be a controlled dam. Colonel Setliffe stated that the 156 foot elevation was the maximum planned elevation for flood waters but the final design elevation might be several feet higher or lower. Mr. Beach pointed out that the cost of land for these projects (Newark and Christiana) would be prohibitive if purchase was delayed until the dates indicated in the schedule. Colonel Setliffe replied that all concerned with these projects were aware of increasing economic costs and need for early acquisition of planned project areas.

200. Mr. Robert Struble, questioned the need for Newark and Christiana dams only two years apart when it did not appear any extra water would be needed up to 1978. Colonel Setliffe stated that the needs were determined in agreement with the State of Delaware and any differences of opinion as to time of need could be discussed later.

201. General Norman M. Lack, USA (Retired), Water Research Foundation, Wilmington Trust Building, Wilmington, Delaware, stated that the comprehensive plan did not do much for the lower part of the State of Delaware. He felt that the cost of pipelines would be prohibitive for the State of Delaware to bear, and that further consideration should be given to the barrier. Colonel Setliffe remarked



that the Corps of Engineers did not make the Federal government's laws and that the Corps of Engineers did not decide whether the Federal government will make contribution to nothing other than flood control. There being no further questions or comments, the hearing was adjourned.

XI      PUBLIC HEARING AT PORT JERVIS, NEW YORK  
4 May 1960

202. Colonel T. H. Setliffe, District Engineer, conducted the hearing in the auditorium of Sullivan School, Port Jervis, New York, on 4 May 1960. His presentation covered the same material presented in the same manner with Vugraph slides, etc., as summarized for the public hearing at Phillipsburg, New Jersey, held 13 April 1960. The Tocks Island project was covered in additional detail in anticipation of specific questions relative thereto. After presentation of the plan of development Colonel Setliffe called for comments which are briefed in the following paragraphs.

203. Honorable Kristen Kristensen, Mayor, Yonkers, New York and Chairman, Water Supply Committee of the Metropolitan Regional Council, asked no specific question but emphasized in detail the growing need for increased water supply in the New York Metropolitan Region, including 21 counties and 15 major municipalities. He also emphasized the need for new governmental mechanisms or relationships to carry out important proposals in the development plan and pledged the cooperation of the Council in the undertaking.

204. Miss Irene M. Hoppey, Executive Secretary, Chamber of Commerce, Port Jervis, New York, read a three-part Statement pledging cooperation of the Chamber.

205. Mr. Charles Koons, Sandyston Community Club, Layton, New Jersey, asked if there was any agency to help landowners who would have to move because of the (Tocks Island) project. Colonel Setliffe stated that he knew of no governmental agency which had such a mission.

206. Mr. Martin R. Snook, Sussex County Historical Society, Newton, New Jersey, asked if the Corps of Engineers would go along with preserving any historical sites and buildings in the Tocks Island site. Colonel Setliffe stated that major consideration is given to such matters in cooperation with state agencies.

207. Mr. John De Korte, Milanville Dairy, Milanville, Pennsylvania, asked, in effect, what consideration had been given to alleviating flood damage in Milanville. Colonel Setliffe stated there was no specific project for the town. Mr. Morgan stated that a reservoir site had been investigated above the town but could not be justified. Dr. Goddard stated that the Commonwealth of Pennsylvania had received a request from the community and was scheduling a study of the problem.

208. Mr. C. V. Crane, Port Jervis, New York, stated that the 428-foot elevation would necessitate some diking along the Minisink River, and asked what the safeguards would be from flash floods.

Colonel Setliffe stated that projects were planned for a certain "design" flood but would not cover all floods. Mr. Crane asked if there would be release of water from Tocks Island dam in case of a flash flood. Colonel Setliffe said that indeed there would be releases, based on weather forecast reports.

209. Mr. Adolph A. Lohse, Layton, New Jersey, assumed that it would be about 8 or 10 years before they had to move out of homes in the vicinity of Dingmans bridge. Colonel Setliffe said that was about as close as anyone could estimate at the present time.

210. Mrs. Amelia Ruchert, Peakville, New York, asked how much time would people have in which to depart after their property was acquired for a project. Colonel Setliffe answered that the time varied with the size of the project; but was generally a year to fifteen months before the completion of a project.

211. Mrs. Emil Janus, Port Jervis, New York, asked by whom would property be purchased. Colonel Setliffe and Dr. Goddard stated that the purchase was usually a coordinated matter between the state and Federal government.

212. Mr. V. C. Curtis, Callicoon, New York, asked whether there has been a survey of the Callicoon Creek area. Colonel Setliffe stated that it is one of the 39 sites he had mentioned to be a project.

213. Mr. Samuel Levine, Monticello, New York, asked if there was anything which might change the order of precedence of the construction of the projects. Colonel Setliffe stated that there were number of things which might do that; explained why, and added that no major change was likely.

214. Mr. Richard Hoffman, Port Jervis, New York, asked whether some of the recommended projects were in the way of progress now. Colonel Setliffe stated that none had been authorized by Congress, none had been funded and none were being built.

215. Mrs. P. J. Sundheim, Sparta, New Jersey, asked whether the financial value of a project such as Tocks Island could be written down - would it be all Federal funds or would other funds be required to complete a project. Colonel Setliffe stated that Tocks Island was a prime example of a multiple-purpose project, and explained the related responsibilities of Federal, State and other interests. He also stated that progress depended on the availability of Federal and state funds.

216. Mr. C. W. Dean, Port Jervis, New Jersey, asked whether copies of maps and related information would be available on a mailing list or other publicity basis. Colonel Setliffe stated

that if anyone wrote in for a final outline of the pool their name would be put on a mailing list. He also stated that VSGS maps showing contours were available and anything below the 428-foot elevation would be under water, both at Tocks Island and Port Jervis.

217. Mr. Fred Dix, Supervisor, Hancock, New York, asked if the proposed dam at Hawks Mountain would be taxable since it would take out 25% of their assessed valuation. Colonel Setliffe stated that it would not be taxable, but some recompense had been made in similar instances. He also stated that he was not promising any money. Mr. Dix then stated his opposition to the dam unless some provision were made for providing the equivalent of tax loss.

218. Mr. Martin R. Snook, Newton, New Jersey, asked if there was an official effort to discourage development (on project sites) or is it the policy to let economics take its course. Colonel Setliffe stated that the problem was recognized and that continuing development at potential future reservoir sites frequently makes the project later uneconomical for construction. It is a matter of national significance which has been recognized by the Senate Committee on Water Resources. An effort is being made toward legislation to permit buying sites in advance of the time of their need for construction.

219. Mr. Samuel Levine, Monticello, New York, asked how annual damage was ascertained, particularly on the East or West Branches of the Delaware River. Colonel Setliffe stated that it was determined, in a way, on an amortization basis based on records of flood damages and sizes. Mr. Levine specifically questioned how the \$35,000 average annual damage figure was determined for the East Branch. Colonel Setliffe stated the arithmetic took more time than justifiable before the group but he would be glad to show the figures or mail the answer. With no further questions the meeting adjourned.



APPENDIX A  
HISTORY OF INVESTIGATION

EXHIBIT C  
PRIOR WATER RESOURCES REPORTS

# EXHIBIT C

## PRIOR WATER RESOURCES REPORTS

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## EXHIBIT C

### PRIOR WATER RESOURCES REPORTS

#### I REPORTS BY THE CORPS OF ENGINEERS.

1. Prior reports on this river by the Corps of Engineers fall logically into five major groups in accordance with the classes of investigations which they cover. Group One consists of the eight comprehensive basin reports authorized by the River and Harbor Act of 21 January 1927, in accordance with provisions of House Document No. 308, 69th Congress, 2d Session. House Document No. 179, 73d Congress, 2d Session, which is the principal report considered in this review, is in this group. Group Two consists of fourteen flood control reports, six of which were authorized by the Emergency Relief Appropriation Act of 1935, one by the River and Harbor Act of 1935 and seven by subsequent Flood Control Acts. Group Three includes five review reports of prior investigations requested by Congressional Committees, to determine whether changed conditions justified changing prior recommendations resulting from these prior investigations. Group Four reports cover pollution conditions in the Schuylkill River and plans for their correction. Group Five includes the principal investigations for improvement of navigation facilities in the tidal portions of the Delaware River and its lower basin tributaries, as well as Delaware Bay and its tributaries. Reports on investigations for a navigation canal across New Jersey, linking New York Bay with Delaware River, as a part of the Atlantic Intracoastal Waterway, and on the Chesapeake and Delaware Canal are also included in Group Five. Table 1 lists the reports in Groups One to Four and the more important reports in Group Five.

## II PRIOR REPORTS BY OTHER AGENCIES

2. Various proposals for development of portions of the water resources of the Delaware River basin have been made by the states and cities in the basin, as well as by interstate and private organizations. A considerable number of technical reports are available covering these proposals. The more important and recent of these reports are summarized below.

### 3. Reports on Upland Water Supply for the City of Philadelphia.

The Philadelphia Water Commission in 1945 employed a Board of Consulting Engineers to make a comprehensive survey of Philadelphia's future water supply needs. This Board consisted of Charles A. Emerson, Francis S. Friel, Nathan Jacobs, Joel D. Justin and Gustav J. Requardt, with William D. Williams as Executive Engineer.

4. The Board submitted a preliminary report on 16 November 1945 which covered its investigation of several proposals for developing an upland water supply for Philadelphia to provide 500 million gallons per day for 2,400,000 persons by the year 2000. Under the proposed project the entire city would be furnished with water from Delaware River, and Schuylkill River would be abandoned as a source of water supply. It would consist of a storage reservoir on Delaware River at Wallpack Bend, and intake works near Yardley, Pennsylvania. The river channel would be used to convey water from Wallpack Bend to the intake works at Yardley where it would be pumped to the Philadelphia filtration plants. The existing filtration and distribution facilities would be enlarged and improved to process and carry the larger volume of water.

5. The Board submitted its final report, entitled "Development of an Upland Source of Water Supply and Suitability of Existing Sources of Supply with Augmented Facilities" on 15 April 1946. This report supplemented the preliminary one and developed further details and costs of the plan of development proposed and designated as the "Delaware River Project." The proposed project would consist of a storage reservoir on Delaware River at Wallpack Bend; a regulating reservoir on Little Neshaminy Creek, near Warrington, Bucks County, Pennsylvania; concrete lined tunnels from Wallpack Bend Reservoir to the regulating reservoir and from that point to the existing Queen Lane Filter Plant. This filtration plant would be remodeled and equipped with rapid-sand filters and new transmission conduits would be constructed to provide additional connections to the existing distribution system.

6. The Board estimated the cost of providing the new 500 million gallons per day supply at \$284,588,000 with an additional cost of \$62,568,000 for improving and augmenting the existing system. It



## EXHIBIT C

TABLE 1

PRIOR REPORTS BY CORPS OF ENGINEERS, U. S. ARMY  
DELAWARE RIVER WATER RESOURCES INVESTIGATIONS

Location	Authority	Report by District Engineer		Report by Chief of Engineers		Publication		Work Recommended or Considered
		Scope	Date	Recommendation	Date	Document Source Number	Comments Number Session	
GROUP ONE - COMPREHENSIVE BASIN INVESTIGATIONS								
Delaware River Basin	R. & H. Act 1/21/27	P	3/24/32	Unfavorable	10/9/33	House 179	73d	2d
Shohola Creek Basin	R. & H. Act 1/21/27	P	1/15/31	Unfavorable	12/9/31	House 155	72d	1st
Mongaup River Basin	R. & H. Act 1/21/27	P	5/20/30	Unfavorable	12/3/30	House 660	71st	3d
NeverSink River Basin	R. & H. Act 1/21/27	P	11/30/30	Unfavorable	12/9/31	House 147	72d	1st
Lehigh River Basin	R. & H. Act 1/21/27	P	9/25/31	Unfavorable	2/4/32	House 245	72d	1st
Tohickon Creek Basin	R. & H. Act 1/21/27	P	9/15/29	Unfavorable	6/18/30	House 486	71st	2d
Neshaminy Creek Basin	R. & H. Act 1/21/27	P	2/28/30	Unfavorable	5/23/30	House 429	71st	2d
Perkiomen Creek Basin	R. & H. Act 1/21/27	P	6/28/29	Unfavorable	6/18/30	House 482	71st	2d
GROUP TWO - FLOOD CONTROL INVESTIGATIONS								
Lehigh R. at Northampton, Pa. of 1935	E.R.A. Act of 1935	S	8/5/37	Unfavorable	---	---	Not published	2/
Lehigh R. at Allentown, Pa. of 1935	E.R.A. Act of 1935	S	3/15/38	Favorable	---	---	Not published	2/
Lehigh R. at Bethlehem, Pa. of 1935	E.R.A. Act of 1935	S	11/4/38	Favorable	---	---	Not published	2/
Lehigh R. at Freemansburg, Pa. of 1935	E.R.A. Act of 1935	S	8/4/37	Unfavorable	---	---	Not published	2/
Lehigh R. at Easton, Pa. of 1935	E.R.A. Act of 1935	S	2/8/38	Unfavorable	---	---	Not published	2/
Streams in N. Y. and Pa. affected by July 1935 Flood	E.R.A. Act of 1935	S	6/15/36	Favorable	---	---	Not published	
Delaware R. between Easton and Stroudsburg, Pa.	R. & H. Act 6/30/35	P	1/27/36	Unfavorable	4/20/36	---	Not published	

Improvements for navigation, flood control, power development, irrigation and water supply were considered.  
Improvements for navigation, control of floods, development of power and irrigation were considered.  
Improvements for navigation, irrigation, flood control and power were considered.  
Improvements for navigation, power development, flood control and irrigation were considered.  
Improvements for navigation, power development, flood control, irrigation and the conservation of the water resources of the Lehigh River were considered.  
Improvements for navigation, power development, flood control and irrigation were considered.  
Improvements for navigation, power development, flood control and irrigation were considered.  
Improvements for navigation, flood control, power and irrigation were considered.

Leaves and concrete walls for flood protection were considered.  
Local flood protection works, consisting of levees, flood walls and drainage and pumping facilities were recommended. A project to afford local flood protection was recommended.  
Local flood protection works were considered.  
Local flood protection works were considered.  
Flood protection works consisting of 41 reservoirs, 7 channel improvement projects and 8 check dam projects were recommended.  
Improvements for navigation, flood control, hydropower and water supply were considered.

1/ "p" denotes "Preliminary Examination," and "S" denotes "Survey."  
2/ Report revised and portions included in Survey Report on Lehigh River, dated 15 November 1944 and published as H. Doc. No. 587, 79th Congress, 2d session.

EXHIBIT C  
TABLE 1

PRIOR REPORTS BY CORPS OF ENGINEERS, U. S. ARMY  
DELAWARE RIVER WATER RESOURCES INVESTIGATIONS

Location	Authority	Report by		Report by		Publication		Work Recommended or Considered
		Scope	District Engineer Date	Recommendation	Chief of Engineers Date	Document		
						Source Number	Congress Number Session	
GROUP TWO - FLOOD CONTROL INVESTIGATIONS - Continued								
Delaware R., Tinicum Township	F. C. Act 6/22/36	P	11/30/36	Unfavorable	4/28/37	Unfavorable	Not published	The reconstruction of dikes for flood control had been provided through the aid of Federal relief agencies; therefore no additional studies were recommended.
Delaware R. and Tributaries near Morrisville, Pa.	F. C. Act 6/28/38	P	2/28/40	Unfavorable	3/29/43	Unfavorable	Not published	Improvements for navigation, water power, water supply and flood control were considered.
Pequest River Basin	F. C. Act 8/11/39	S	4/8/42	Favorable	3/29/43	Unfavorable	Not published	Channel improvement from Long Bridge to Townsboro was considered, but the problem was determined to be in land drainage for reclamation rather than one of flood control.
Neshaminy Cr., Bucks Co., Pa.	F. C. Act 8/11/39	P	4/15/40	Unfavorable	7/1/41	Unfavorable	Not published	Power development, domestic water supply, navigation, water power, flood control and irrigation were considered.
Frankford Cr., Phila., Pa.	F. C. Act 6/28/38	P	2/15/39	Unfavorable	12/19/39	Unfavorable	Not published	Improvement for flood control and navigation were considered.
Rancocas Cr., N. J.	F. C. Act 8/28/37	---	---	---	12/6/40	Favorable	House 128 77th	Channel improvements and a bypass channel, in the Township of Mount Holly, were recommended.
Schuylkill River Basin	F. C. Act 7/24/46	P	12/12/47	Unfavorable	6/2/50	Unfavorable	Not published	Improvements for flood control were considered.
GROUP THREE - REVIEW OF PRIOR INVESTIGATIONS								
Delaware River Basin (Lackawaxen River)	Res. H. F. C. S Comm. 10/8/42	S	6/1/44	Favorable	7/12/46	Favorable	House 113 80th	Flood control, by the provision of Dyberry and Prompton Reservoirs, was recommended.
Delaware River Basin (Lehigh River)	Res. H. F. C. S Comm. 10/20/42	S	11/15/44	Favorable	1/31/46	Favorable	House 587 79th	A reservoir near Bear Creek and local protective works in Allentown and Bethlehem were recommended.
Delaware River Basin	P. L. Nos. 468/74/2 738/74/2 406/75/1	P	3/2/38	Favorable	6/11/38	Partly Favorable	Not published	Local flood protection works and improvement for power, water supply development and navigation were considered. A survey was recommended.
Delaware River Basin	Res. H. F. C. Comm. 3/19/37	S	1/15/41	Unfavorable	---	---	Not published	A comprehensive system of reservoirs for flood control, power and water supply was considered.
Delaware River Basin	P. L. Nos. 468/74/2 738/74/2 406/75/1	S	1/15/41	Unfavorable	---	---	Not published	
Delaware River Basin	Res. H. F. C. Comm. 3/19/37	P	7/31/46	Unfavorable	1/20/48	Unfavorable	Not published	Construction of dams in the vicinity of Tocks Island, Belvidere and Chestnut Hill for the development of hydroelectric power, improvement of navigation and water supply was considered.

Sheet 2 of 4  
"P" denotes "Preliminary Examination," and "S" denotes "Survey."

EXHIBIT C  
TABLE 1  
PRIOR REPORTS BY CORPS OF ENGINEERS, U. S. ARMY  
DELAWARE RIVER WATER RESOURCES INVESTIGATIONS

Location	Authority	Report by District Engineer		Chief of Engineers	Report by	Document		Publication	Work Recommended or Considered
		Scope	Date			Recommendation	Date		
GROUP FOUR - STREAM POLLUTION INVESTIGATIONS									
Schuylkill River	R. & H. Act 1/21/27	P	2/24/28	Unfavorable	12/5/28	Unfavorable	House	469 70th	2d
Schuylkill River	Res. Comm. on R. & H. 4/8/35	S	5/15/37	Favorable	7/26/38	Favorable	House	183 76th	1st
Schuylkill River	R. & H. Act 3/2/45 Res. S. Comm. on Commerce 5/20/44 Res. H. R. & H. Comm. 3/8/45	S	4/2/45	Favorable	12/17/45	Favorable	House	529 79th	2d
GROUP FIVE - NAVIGATION IMPROVEMENT INVESTIGATIONS									
Delaware River Philadelphia to Trenton	Res. R. & H. S Comm. 4/21/32	S	1/12/33	Favorable	5/26/33	Favorable	House	11 73d	1st
Philadelphia to the Sea	Res. Sen. Commerce Comm. 6/12/35	S	2/15/37	Partly Favorable	3/7/38	Partly Favorable	Senate	159 75th	3d
Philadelphia to the Sea	Res. R. & H. S Comm. 4/8/38	S	6/16/39	Partly Favorable	1/11/40	Partly Favorable	House	580 76th	3d
Philadelphia to Trenton and Phila. to the Sea	R. & H. Act 7/24/40 Res. Sen. Comm. on P.W. 4/13/40 Res. H. Comm. on P.W. 5/21/41	S	1/13/53	Favorable	11/18/53	Favorable	House	358 83d	2d
Intracoastal Waterway New York Bay - Delaware R.	Res. S. Comm. on Com. 12/15/30 Res. R. & H. Comm. 6/25/43 Res. H. R. & H. Comm. 3/23/34	S	6/20/41	Favorable	7/14/41	Favorable	Senate	139 79th	2d
New York Bay - Delaware R.	Res. R. & H. Comm. 6/25/43	S	5/15/46	Favorable	---	---	Not published		Augmentation of water supply for proposed canal.
New York Bay - Delaware R.	Res. H. R. & H. Comm. 3/23/34	S	2/28/55	Favorable	3/28/36	Unfavorable	Comm. R. H. House	93 74th	2d

Devising methods for eliminating the source of pollution resulting in deposits of coal dust or culm in the river were considered.  
A general plan for arresting further pollution at the source and for restoring the river to its original condition by the State, local interests and the anthracite industry was presented.  
A project for removing culm deposits from the Schuylkill River between Norristown and Philadelphia was recommended, subject to the Commonwealth of Pennsylvania eliminating the further introduction of culm into the river and undertaking the removal of accumulated deposits from the riverbed above Norristown.

Channel 300 feet wide. Project depths of 28 and 25 feet from Philadelphia to Trenton.  
Channel 800 feet wide. Project depths 37 and 40 feet.

Channel - Allegheny Ave. to Camden Bridge. Project depth 37 feet.  
Modification of existing projects to provide channels 400 feet wide and 40 feet deep, and 300 feet wide and 35 feet deep.

Canal along Sayreville - Bordentown route.

Augmentation of water supply for proposed canal.

A waterway between Delaware River and Raritan River was considered.

1/ "P" denotes "Preliminary Examination," and "S" denotes "Survey."

EXHIBIT C  
TABLE 1  
PRIOR REPORTS BY CORPS OF ENGINEERS, U. S. ARMY  
DELAWARE RIVER WATER RESOURCES INVESTIGATIONS

Location	Authority	Report by District Engineer		Chief of Engineers		Publication		Work Recommended or Considered	
		Scope	Date	Recommendation	Date	Recommendation	Source Number		Number
GROUP FIVE - NAVIGATION IMPROVEMENT INVESTIGATIONS - Continued									
Inland Waterway from Delaware R. to Chesapeake Bay, Del. and Md.	Res. S. Comm. on Com. 3/28/39	S	2/15/50	Favorable	8/17/53	Favorable	Senate 123 83d	2d	Channel 450 feet wide and 35 feet deep; one railroad and two highway bridges; anchorage area, 35 feet deep, 1,200 feet wide, and 3,700 feet long.
Delaware R. at Camden, N. J.	R. & H. Act 4/6/13	S	5/12/14	Favorable	7/8/14	Favorable	House 1120 63d	2d	Channel - Newton Creek to Cooper Point. Project depths 18 and 30 feet.
Delaware R. at Camden, N. J.	R. & H. Act 3/19/25	S	4/18/27	Favorable	12/10/27	Favorable	House 111 70th	1st	Extending 30-foot depth upstream to Berkley St. terminal.
Delaware R. at Camden, N. J.	Res. H. R. & H. Comm. 2/16/40	S	12/3/40	Favorable	6/3/41	Favorable	House 353 77th	1st	Channel - 37-foot depth in front of Camden marine terminals.
Wilmington Harbor, Del.	Res. H. R. & H. Comm. 1/30/29	S	11/9/29	Favorable	1/30/30	Favorable	R. H. Comm. 20 71st	2d	Channel - Delaware River to Lobdell Canal. Project depth 30 feet; and removal of portion north jetty.
Schuylkill River, Pa.	R. & H. Act 3/2/45	S	11/30/45	Favorable	5/7/46	Favorable	House 699 79th	2d	Channel - Delaware River to Passyunk Ave. Project depth 33 feet. Restoration of channel dimensions from Passyunk to University Ave.; full maintenance of project.

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estimated that the abandonment of the Schuylkill portion of the system and the supplying of all of the water from the Delaware would require an increased construction cost of about 25 million dollars. The total estimated annual charges were \$22,957,000. The abandonment of the Schuylkill supply would increase the annual costs by about \$786,250, according to the Board's report.

7. The report also included preliminary cost estimates for each of the seven other upland water supply projects discussed in the preliminary report. Six of these would each provide the 500 million gallons per day required, and one, the Upper Lehigh River Basin Project, would provide only 331 million gallons. The proposed Delaware River Project was developed from modifications of some of these projects. No action appears to have been taken on this report by the City of Philadelphia.

8. Report of the Interstate Commission on the Delaware River Basin.

Reciprocal legislation was passed in 1949 by the Legislatures of New York, New Jersey and Pennsylvania which directed the Interstate Commission on the Delaware River Basin (INCodel) to conduct an investigation in order to determine whether it was advisable for the three States to develop an integrated water supply project in the Upper Delaware basin for their mutual use and benefit. The services of Malcolm Pirnie Engineers, New York City, were engaged by INCodel to make the necessary engineering investigations and prepare the report. The Philadelphia firm of Albright and Friel, Inc., became an affiliate of the New York firm to assist in this study and report. The consulting engineers submitted their report to the Commission on 17 August 1950, and their recommendations were approved and adopted, in principle, by the Commission on 11 September 1950.

9. The report by the consulting engineers is entitled "Report on the Utilization of the Waters of the Delaware River Basin." The recommended plan contained therein, is commonly known as the "INCodel Plan." The plan, in brief, provided for a reservoir of 118 billion gallons capacity on West Branch Delaware River at Cannonsville, New York; a diversion dam and reservoir of 10 billion gallons capacity on the main stem of the Delaware River near Barryville, New York; a reservoir having a capacity of 278 billion gallons on Neversink River and Basher Kill, extending from Godeffroy to Phillipsport, New York; a diversion tunnel from Barryville Reservoir to Neversink Reservoir, and another from the latter reservoir to the then existing main supply tunnels in New York City. The plan also provided for connections between the latter diversion tunnel and the water supply systems of northeastern New Jersey. This system of reservoirs, having a total capacity of 406 billion gallons, and tunnels was designated Alternate A of Stage 1. Alternate B of Stage 1, included the elements of Alternate A plus a reservoir of 121 billion gallons capacity on the

main stem at Wallpack Bend, and had a total storage capacity of 527 billion gallons.

10. The plan provided that under either of the two alternates for Stage 1, New York City and northeast New Jersey would be supplied a total of 465 million gallons of water per day to meet anticipated needs to the year 1980. This would be in addition to the 440 million gallons per day, which New York City was permitted to divert from the Delaware River under the 1931 decree of the U. S. Supreme Court. However, the plan also provided that during periods of low flow, sufficient water would be released from the reservoirs to maintain the stream flow at Trenton at 4,000 cubic feet per second under Alternate A, and 4,800 cubic feet per second under Alternate B.

11. The estimated cost of construction, including interest during the construction period, and based on 1950 prices was about \$585,930,000 for Alternate A, and \$642,560,000 for Alternate B. Annual charges for Alternate A were estimated at about \$23,319,400, of which \$18,095,500 would be allocated to water supply and compensation for diversion; \$4,523,900 to additional stream flow regulation; and \$700,000 estimated as the return from the hydroelectric power produced. Annual charges for Alternate B would be about \$25,848,700 of which \$18,095,500 would be allocated to water supply and compensation for diversion; \$6,753,200 to additional stream flow regulation; and \$1,000,000 estimated as the return from hydroelectric power.

12. The additional water needs of New York City and northern New Jersey were estimated to increase by 465 million gallons per day between 1980 and the year 2000 to a total of 930 million gallons per day. Stage 2 of the plan was designed to provide the 465 million gallons per day of additional water needed by the year 2000 for these two areas, and to provide also 800 million gallons per day for the lower Delaware basin, including Philadelphia, the southern New Jersey metropolitan district, the Philadelphia Suburban Water Company, the Pennsylvania sub-basin area between Easton and Philadelphia, and the Wilmington area. This stage would add Wallpack Bend Reservoir if it were not already constructed under Stage 1, Fishs Eddy Reservoir (capacity 157 billion gallons), and Flat Brook Reservoir (capacity 84 billion gallons) to the facilities constructed in Stage 1 of the plan. The entire plan would provide, by the year 2000, a total of 1,730 million gallons per day, in addition to the 440 million gallons per day authorized for diversion by New York under the 1931 Supreme Court decree.

13. The construction of the project would be financed by the issuance of revenue bonds which would be paid off with the proceeds resulting from the sale of water to New York City and the northern New Jersey municipalities. In addition, a portion of the annual cost of the project, under either Alternate A or Alternate B, would be al-

located to stream flow regulation and apportioned among the four States. The allocations of annual costs for this purpose were \$4,523,900 for Alternate A and \$6,753,200 for Alternate B. The recommended apportionment of these allocations among the States was as follows:

	Stage 1 - Alternate A (without Wallpack Bend)		Stage 1 - Alternate B (with Wallpack Bend)	
	Dollars	Percent	Dollars	Percent
New York	\$1,131,000	25.0	\$1,131,000	16.8
New Jersey	1,583,350	35.0	2,642,250	39.1
Pennsylvania	1,583,350	35.0	2,642,250	39.1
Delaware	<u>226,200</u>	<u>5.0</u>	<u>337,700</u>	<u>5.0</u>
TOTALS	\$4,523,900	100.0	\$6,753,200	100.0

Since New York would derive no benefit from Wallpack Bend Reservoir, the charge against New York would be the same under either alternate plan. A limited amount of hydroelectric power would be generated and its revenue used to pay part of the annual charges.

14. The consulting engineers recommended immediate consideration of an interstate compact to establish a Delaware River Water Commission; that the Commission have appropriate representation from the four States; that the Commission be authorized to plan, finance, construct and operate the Stage 1 integrated water project; that the Commission be empowered to sell water service capacity to political subdivisions and other water supply agencies, and to provide and receive supporting revenues from stream flow regulation which would benefit each of the States. New York, New Jersey and Delaware passed legislation approving the plan, but Pennsylvania rejected it.

15. Report by the Pennsylvania Water Resources Committee.

The Governor of the Commonwealth of Pennsylvania appointed a committee in June 1951 to examine the INCODEL Plan contained in the report dated August 1950. The committee was designated as the Pennsylvania Water Resources Committee, and consisted of Albert M. Greenfield, Chairman, Thomas Buckley, C. Jared Ingersoll, Samuel S. Lewis, Horace P. Liversidge, William D. Mason, Frederick A. Potts, Casimir A. Sienkiewicz, and Andrew J. Sordoni. It engaged Greeley and Hansen, of Chicago, Illinois; the Chester Engineers, of Pittsburgh, Pennsylvania; and Gannett, Fleming, Corddry & Carpenter, Inc., of Harrisburg, Pennsylvania, to make the required engineering studies and recommendations.

16. The Governor in his letter to the committee assigned it the following tasks:

a. Determine whether under the proposed INCODEL Plan Pennsylvania would be in a more favorable position than it then was under the decree of the Supreme Court of the United States regarding the use of the water of Delaware River by the four States bordering thereon.

b. Determine whether the proposed INCODEL Plan, or any modification thereof, would protect the interests of the Commonwealth adequately if the Committee found that Pennsylvania ought to become a party to the INCODEL Compact under which the plan would be executed.

c. Make a preliminary study of the unused water supply resources of Pennsylvania and determine to what extent the southeastern part of the Commonwealth is dependent for its water supply upon the continued use of the Delaware River.

d. Make a preliminary study of the water supply of the Commonwealth so that the results of the study could be a basis for recommending legislation aimed at conserving the water supply resources of Pennsylvania.

17. Funds appropriated in 1951 for meeting the needs of the Committee were limited to expenses "necessary for the study of the water resources of the Delaware River basin, including the INCODEL Plan." Accordingly, the Committee confined its activity to the study of the Delaware basin and the INCODEL Plan.

18. The Committee's report, entitled "Report of the Pennsylvania Water Resources Commission" was submitted to the Governor on 6 February 1953. The Committee found from its study of the INCODEL Plan that it was apparent from its description that, insofar as water supply was concerned, the plan was for the benefit of New York City and northeastern New Jersey municipalities. Also it appeared that Philadelphia and southeastern Pennsylvania could benefit from the water supply features of the plan only if and when Wallpack Bend Reservoir were constructed, and if and when the Philadelphia Metropolitan Area desired to obtain water under the provisions of the plan and were willing and able to finance the means to carry the water from Wallpack Bend, or from an intake at or near Yardley, to reservoirs and filter plants in the Philadelphia Metropolitan Area.

19. The Committee also noted that the plan provided for water of prime quality to be furnished to New York City and northeastern New Jersey, whereas Pennsylvania would be furnished with polluted water that would require filtration. In addition, the Committee noted no assurance was given to Pennsylvania that there would be sufficient water available to it during prolonged periods of drought.



20. The Committee felt that, from the Commonwealth's position, there had to be some advantages of considerable import to compensate for the diversion of an additional 930 million gallons per day out of the Delaware basin estimated as required by 2000, and especially so when the lower Delaware basin was entering upon a period of great industrial expansion. Consideration was given to the following advantages which the INCODEL report held would be derived by the lower basin areas:

- a. Improved sanitation.
- b. Salinity control.
- c. Protection of the oyster industry.
- d. Restoration of the shad fisheries.
- e. Improved facilities for recreation.

21. In brief, the Committee concluded as follows with regard to the above alleged advantages.

a. Improved sanitation. Low flow augmentation would have a slight effect on sanitation. The treatment of sewage and industrial wastes, to at least the degree then proposed and to a higher degree in the future, would be more effective in improving the sanitary condition of the river.

b. Salinity control. The frequent and increasing salinity invasions in the Chester-Marcus Hook area would not be eliminated by the amount of low flow augmentation to be provided under the plan.

c. Protection of the oyster industry. The oyster industry is of no real importance to Pennsylvania, but the limited study, made by the Committee's engineers, indicated that the INCODEL project would not appreciably help that industry.

d. Restoration of the shad fisheries. Pollution of the estuary is the main cause of the decline of the shad fishing industry. In view of the conclusion that flow augmentation would not reduce pollution significantly, it followed that the project could not benefit the shad industry appreciably.

e. Improved facilities for recreation. The reservoirs constructed in New York State would be of no material benefit to Pennsylvania because of their remoteness from Pennsylvania population centers and on account of the high non-resident fees for fishing licenses charged by New York.

22. Thus, it appeared to the Committee that there would be no benefits of such importance, accruing to Pennsylvania from the low flow augmentation provided by the plan, that would compensate for the total diversion of 930 million gallons per day in addition to the 440 million gallons per day authorized to be diverted by New York City under the 1931 decree. The Committee, therefore, concluded that there would be no justification for Pennsylvania to bear any of the costs for providing and maintaining reservoirs and dams in New York State for the purpose of furnishing additional water supplies for New York City and northeastern New Jersey.

23. The Committee also considered the question as to whether the Commonwealth should acquiesce to the complete diversion of up to 1,370 million gallons per day from the Delaware basin in the event it were proposed to construct the INCODEL project without cost to Pennsylvania. In this respect the Committee concluded that such comparatively large diversions may have long-range effects that could not be predicted with assurance and, therefore, recommended that the Commonwealth not consent to such diversions. The Committee ended the first task assigned to it with this recommendation.

24. Under its second task, the Committee considered the reciprocal legislation proposed for adoption by the four basin States for the purpose of authorizing the execution of the INCODEL Compact among them. Delaware and New Jersey had passed the act substantially as proposed by INCODEL, and New York adopted the act with major alterations. The provisions of the legislation proposed by INCODEL were such that once a state had executed the Compact, it could not subsequently withdraw from it unilaterally. Only by unanimous agreement among the four States could the Compact be voided, otherwise it would remain in effect in perpetuity. This feature was absolutely unacceptable to the Committee, for it did not consider any representatives of the four States to be gifted with such superior wisdom as to enable them to devise a compact which would serve effectively in the future no matter what circumstances arose.

25. In citing a statement, attributed to advocates of the INCODEL Plan, to the effect that the Compact did not allocate water from the Delaware to New York City and New Jersey, but that such allocations would be the function of the Commission created by the Compact, the Committee drew attention to the fact that the Compact indicated specifically which dams, reservoirs and conduits were to be constructed in the first stage of the execution of the Plan. These facilities were all for the purpose of furnishing additional water supplies to New York City and northeastern New Jersey. The Committee noted that it was proposed to issue revenue bonds in order to finance the construction of the project; however, a prerequisite to the bond issue was the execution, by the Commission and the municipalities concerned, of long term contracts for water. Hence, in

order to finance the project the Commission would be obliged to make allocations of water to New York City and the New Jersey municipalities in the quantities provided for in the Plan. If this were not done, the Committee believed that nothing worthwhile would come of the execution of the Compact.

26. The Committee considered in detail the provisions of the Compact, under which the Commission would function, and the modification of those provisions desired by the State of New York. It concluded that the arrangements were wholly unacceptable to Pennsylvania because, in effect, they left to any one of the other States the final decision regarding the rights of Pennsylvania to its just share of water from Delaware River and that, therefore, the Commonwealth should not be a party to any such compact. The Committee concluded further, that the Commonwealth was in a far more favorable position under the 1931 decree of the Supreme Court of the United States. The Committee, in view of the conclusions reached as a result of its studies, recommended that Pennsylvania not become a party to the INCODEL Compact.

27. With regard to alternatives to the Commonwealth's participation in the INCODEL Plan, the Committee indicated that Pennsylvania and New Jersey, under an agreement, could construct the Wallpack Bend Reservoir when the need for additional water supply arose in the future and it was found necessary to go upland for such supplies. The Committee also outlined four additional projects in Pennsylvania and one in New Jersey as possible future developments for water supply. Those in Pennsylvania are described as the Lehigh-Nescopeck Project, the Lehigh-Tobyhanna Project, and McMichaels-Pocono Project, and the Pohopoco Project. The New Jersey project is Flat Brook Reservoir. As for legislation the Governor might recommend to the Legislature, the Committee suggested the establishment of a state water authority empowered to investigate and conserve all of Pennsylvania's unused water resources.

28. Report on Wallpack Bend Dam and Reservoir.

The Pennsylvania Department of Forests and Waters placed a contract on 25 May 1955 with Albright & Friel, Consulting Engineers, to prepare plans and cost estimates for a dam and reservoir at Wallpack Bend, on Delaware River. The report under this contract was submitted to the Department of Forests and Waters on 1 September 1955. The report stated the dam would be a concrete structure approximately 1,850 feet long, built across the Delaware at Wallpack Bend, where the river cuts through the Kittatinny Mountains. The resultant reservoir, approximately 26 miles long, would have a capacity of 121 billion gallons (370,000 acre-feet). The reservoir capacity between the top and the bottom of the 17 flow-controlling Tainter gates, would be 62 billion gallons (190,000 acre-feet). The estimated construction cost of the

project based on 1 August 1955 price levels was about \$70,450,000. These costs, including contingency, administration, engineering and other related costs, were subdivided as follows:

- a. Reservoir, including land acquisition  
road relocations and bridges - - - - - \$36,072,520
- b. Dam, including fishway - - - - - 29,116,169
- c. Pennsylvania State Parks adjacent to  
reservoir - - - - - 1,447,886
- d. Power Plant - - - - - 3,817,550

The annual operating cost of the project was estimated at \$77,500.

29. The report stated that the scenic beauty of the reservoir would provide an ideal recreational area and suggested that the usual water activities be permitted in the lake. Bathing beaches and automobile parking areas were proposed for four recreational areas comprising 3,580 acres.

30. With reference to the flood control value of the proposed reservoir, the report stated that, assuming the water level of the reservoir to have been at elevation 396 during the storm of August 1955 (Hurricane Diane), the flow regulation afforded by the reservoir would have reduced the flood stage of the river by approximately five feet. The assumption of the water level at elevation 396 was based on the view that normally reservoir levels are comparatively low during summer months.

31. With reference to water supply and stream flow regulation, the report referred to "Report on the Utilization of the Waters of the Delaware River Basin," prepared by Malcolm Pirnie Engineers and Albright & Friel, Inc., in 1950 for The Interstate Commission on the Delaware River Basin.

32. The report stated that a study to determine the effect of the operation of New York City's Delaware River basin water supply reservoirs and Wallpack Bend Reservoir on stream flows in the Delaware River, showed that the flow at Trenton, which has been as low as 800 million gallons per day (1,235 cubic feet per second) could be increased to a minimum flow averaging 2,200 million gallons per day (3,400 cubic feet per second).

33. The consultants assumed that the hydroelectric power features of the proposed project would be constructed and financed by a public agency and leased to and operated by privately-owned power



companies. They gave consideration to the sale of falling waters to such power companies, which could then finance, construct and operate the power installation. The estimated future power value under these assumptions was given as approximately \$373,000 per year.

34. On 20 January 1956 the Senate Committee on Public Works adopted a resolution requesting that the feasibility of constructing and operating this reservoir, or a similar one at Tocks Island, on a cooperative basis by the United States, and Pennsylvania and New Jersey, as a part of the comprehensive water resources plan, be determined.

35. Report on Survey of New Jersey Water Resources Development.

The New Jersey Legislative Commission on Water Supply entered into a contract on 3 May 1955 with the consulting firm of Tippetts-Abbett-McCarthy-Stratton, Engineers, New York, for that firm to make a survey of the water supply potential of the State of New Jersey. The preliminary report of this firm was submitted on 15 July 1955 and the final report on 31 December 1955.

36. The final report on the survey stated that specific studies of surface and ground water resources show that there are sufficient potential water resources available to the State of New Jersey to provide for predictable needs. All of the State's water requirements to the year 2,000 can be met entirely from resources within the boundaries of the State. These can be developed without interstate agreements, or approval of the Supreme Court of the United States. There are, however, economic advantages in using water from the interstate Delaware River to provide the additional supplies which will be needed in the State's Northeastern Region after 1965. Twelve plans for the diversion of Delaware River water to the Raritan and Passaic River basins for use in the northeastern region were investigated. These include both gravity and pumping diversions. Because of the long tunnels required for gravity diversions such plans are not susceptible to economical stage construction. All of the Delaware diversion plans would require major storage facilities to provide the compensation water necessary to meet anticipated requirements of the U.S. Supreme Court for diversions outside the Delaware River basin. Such compensation storage could be provided by Wallpack Bend Reservoir, or by a reservoir on Flat Brook. Eight of the diversion plans studied were based on the combined use of Wallpack Bend and Flat Brook Reservoirs. Wallpack Bend Reservoir would be used to store and release the water required in the Delaware River to compensate for diversions outside the basin. Flat Brook Reservoir would be used to impound water from the Flat Brook Watershed and to store Delaware River flood waters, by pumping when permissible under the 1954 amended decree of the U.S.

Supreme Court. Of the eight plans considered which use Wallpack Bend and Flat Brook Reservoirs, six provided for diversion of water into the Raritan River basin and two into the Passaic River basin. A brief description of each of the ten plans considered for use of Delaware River water is contained in subsequent paragraphs.

37. Plan DG-1 - 300 Million Gallons per Day Gravity Diversion to Raritan Basin (Frenchtown to South Branch Raritan). Water stored in Flat Brook Reservoir would be released into Delaware River and flow downstream to a diversion dam to be constructed across the river at Frenchtown, New Jersey. A concrete-lined, gravity-type tunnel, 12 feet in diameter and 14.4 miles long, would connect the pool at this diversion dam with the South Branch of Raritan River at a point below Three Bridges. Water would flow down the South Branch and Raritan River to a diversion dam on the latter stream at Bound Brook. At this point a low lift pumping station would raise the water to a coagulation basin. After treatment, water would be pumped by a high lift station through pressure filters into the transmission lines. The estimated capital cost would be \$126,570,000. and the annual charges \$7,292,000.

38. Plan DG-2 - 300 Million Gallons per Day Gravity Diversion to Raritan Basin (Stockton to Bedens Brook). Water stored in Flat Brook Reservoir would be released into Delaware River and would flow downstream to a diversion dam to be constructed across the river at Stockton, New Jersey. A concrete-lined, gravity-type tunnel, 13 feet in diameter and 16.3 miles long, would convey the water to Bedens Brook, a tributary of Millstone River. The water would then flow by natural stream channels to the Bound Brook diversion and treatment plant, where it would be delivered to the transmission mains at a pressure head of 290 feet. The diversion works on both rivers, low-lift pumps, coagulation basin, treatment plant and high lift pumping station would be similar to those in Plan DG-1. This diversion route is the farthest one downstream on the Delaware that could be used for gravity diversion to Bound Brook, and was studied primarily as an alternate to the Delaware and Raritan Canal. The estimated capital cost would be \$136,270,000 and the annual charges \$7,712,000.

39. Plan DG-3 - 300 Million Gallons per Day Gravity Diversion to Raritan Basin (Belvidere to Spruce Run). Water from Flat Brook Reservoir would be released and would flow down Delaware River to a diversion dam to be constructed across Delaware River above Belvidere, New Jersey. A concrete-lined, gravity-type tunnel, 11 feet in diameter and 15.3 miles long, would convey water from this diversion dam to Spruce Run, a tributary of the South Branch of Raritan River, near Clinton, New Jersey. From the tunnel terminal point on Spruce Run, water would be carried by natural stream channels to Bound Brook and pumped to the transmission system in the same manner as described in Plan DG-1. This plan has the advantage over the other plans since its diversion point would be located above the

mouth of the Lehigh River and the water to be diverted would be subject to less polluting influences. The proposed tunnel would pass under Musconetcong and Pequest Rivers and Pohatcong Creek. By creating storage in these streams and diverting them into the tunnel it would be possible to build and operate this plan for progressively increasing yields. The net yields from these streams were estimated as 40 million gallons per day (mgd) for Musconetcong River, 5 mgd for Pohatcong Creek, and 43 mgd for Pequest River including Beaver Brook. Construction of the four reservoirs to provide this tributary storage was estimated to be considerably more costly than the provision of storage in Flat Brook Reservoir. Stage construction of this plan did not appear to be economically feasible for either a primary water supply of 300 mgd, or a supplemental supply of 100 mgd. The estimated capital cost would be \$131,630,000 and the annual charges \$7,512,000.

40. Plan DG-4 - 300 Million Gallons per Day Gravity Diversion to Passaic Basin (Flat Brook to Boonton Reservoir). Under this plan water would be diverted directly from Flat Brook Reservoir to the Boonton Reservoir of the Jersey City System, located on Rockaway River in the Passaic basin. A concrete-lined, gravity-type tunnel, 10 feet in diameter and 31.2 miles long, would be required. Water would be delivered at the elevation of Boonton Reservoir. This reservoir would act only as the eastern terminus of the diversion and would not be used for storage purposes for the new supply. This tunnel cannot be constructed in stages, but the plan would require its full length and the construction of both Wallpack Bend and Flat Brook Reservoirs. The estimated capital cost would be \$152,010,000 and the annual charges \$7,368,000.

41. Plan DG-5 - 300 Million Gallons per Day Gravity Diversion to Passaic Basin (Flat Brook to Wanaque Reservoir). This plan is similar to Plan DG-4 except that the tunnel diverting water from Flat Brook Reservoir would discharge into Wanaque Reservoir, of the North Jersey District Water Supply Commission, on Wanaque River. The tunnel required would be a concrete-lined, gravity-type tunnel, 10 feet in diameter and 29.3 miles long. This tunnel, like that in Plan DG-4, is not susceptible of being developed in stages to meet the growing demands of the Northeastern Region. The estimated capital cost would be \$147,010,000 and the annual charges \$7,148,000.

42. Plan DP-1 - 300 Million Gallons per Day Pumping Diversion to the Raritan Basin (Lambertville to Bound Brook). This plan would require the construction of a pumping station on Delaware River north of Lambertville, New Jersey, and a force main from this station directly into the Bound Brook headworks of the transmission system. The pumping plant would be developed in two stages with a final stage capacity of 375 million gallons per day. It would operate against a static head of 240 feet and a total head of 384 feet. Water would be pumped through three pipes, one with a diameter of 72 inches and two with diameters of 84 inches. These pipes would be approximately 27.3 miles long, and an inspection of their route indicates that this plan would present many operational problems. This condition, together with high construction and operation costs, makes the plan unattractive compared with other

plans for both pumping and gravity diversions. The plan was studied primarily to determine the economics of a pumping diversion route between Delaware River and the Raritan basin that would avoid the use of natural stream channels for any part of the delivery to Bound Brook. The estimated capital cost would be \$127,520,000 and the annual charges \$8,339,000.

43. Plan DP-2 - 300 Million Gallons per Day Pumping Diversion to the Raritan Basin (Lambertville to Back Brook). This plan consists of a pumping station located north of Lambertville, New Jersey, in the same location and with the same capacity as that required for plan DP-1. This plant would operate against a dynamic head of only 191 feet, instead of the 384 feet required in Plan DP-1, and would pump water over the divide between the Delaware and Raritan basins into a tributary of Back Brook south of Ringoes. From this point the water would flow in the natural channels of Back Brook, Neshanic River, South Branch, and Raritan River to Bound Brook. The force mains from Lambertville would be five miles long and consist of one pipe 72 inches in diameter and two pipes 84 inches in diameter. The estimated capital cost would be \$100,570,000 and the annual charges \$6,894,000.

44. Plan DP-3 - 300 Million Gallons per Day Pumping Diversion to Raritan Basin (Washington Crossing to Stony Brook.) This plan differs from DP-2 only in the location of the diversion route. Diversion is from a point on Delaware River about a mile below Washington Crossing, New Jersey. The force main would discharge into a tributary of Stony Brook at Baldwins Corners just south of Pennington, New Jersey. From this discharge point water would flow to Bound Brook via the natural channels of Stony Brook and Millstone River. The force mains for this project would be 4.7 miles in length. This is the shortest practicable pumping route over the Delaware-Raritan divide. Channel and crossing improvements would be required on about six miles of the upper portion of the stream channels to pass the increased flows during maximum diversions. The Washington Crossing pumping plant would have the same size as that at Lambertville in Plans DP-1 and DP-2 except it would be designed for a static head of 180 feet and a total head of 200 feet. The estimated capital cost would be \$99,280,000 and the annual charges \$6,811,000.

45. Plan DRV-1 - 130 Million Gallons per Day Pumping Diversion to Raritan Basin (Frenchtown to Round Valley). This plan is essentially the second stage of the Round Valley project proposed by the North Jersey District Water Supply Commission in its report of 1 November 1954 (not briefed herein). The following changes and additions have been assumed in this project so as to meet requirements for compensating releases and to make it comparable with the other projects investigated.



a. Wallpack Bend Reservoir, or Flat Brook Reservoir, is considered essential in the project for storage of compensation water.

b. Pumping capacity at the Delaware River diversion was increased to 300 mgd in order to comply with diversion restrictions.

c. Transmission of the full yield to the Bound Brook area to conform with distribution requirements and for comparison with other plans using Bound Brook as a common point.

The first stage of development would essentially consist of the first stage of the development of the Round Valley Project as proposed by the North Jersey District Water Supply Commission. Water would be diverted by pumping from the South Branch of Raritan River near Hamden, New Jersey. This water would be stored in an off-stream reservoir developed at Round Valley. A dependable supply of 70 mgd would be developed using a flow line at elevation 380 feet that would store 48.6 billion gallons of water. The Hamden pumping plant would have a capacity of 200 mgd and a maximum static lift of 200 feet. It would pump through a force main 84 inches in diameter and about 3.4 miles long from Hamden to Round Valley. A treatment plant and booster pumps for 90 mgd would be established on Round Valley Reservoir at Lebanon, New Jersey, and a 72-inch diameter transmission main about 18.4 miles long constructed from this plant to Bound Brook. The second stage or Plan DRV-1 would add to this system a Delaware River diversion and pumping plant at Frenchtown, New Jersey. This plant would have a capacity of 300 mgd and would pump through a 96-inch diameter force main, 13.4 miles long from Frenchtown to Round Valley Reservoir. The static lift for this plant would be 265 feet. The Lebanon treatment plant and booster pumps would be enlarged from 90 mgd to a capacity of 250 mgd, and the force main from Lebanon to Bound Brook changed from one 72-inch diameter main to three mains of that size. By the addition of this second stage the yield would be increased from 70 mgd from the South Branch of the Raritan by the 130 mgd diverted from the Delaware to a total of 200 mgd. It was concluded that water for compensation releases for the 130 mgd diverted could be provided, either by constructing Wallpack Bend Reservoir, or by a partial construction of Flat Brook Reservoir. The estimated capital costs with Wallpack Bend Reservoir would be \$115,715,000 and with Flat Brook Reservoir they would be \$109,865,000. The estimated annual charges would be \$6,702,000 and \$6,442,000, respectively.

46. Plan DRV-2 - 300 Million Gallons per Day Gravity Diversion to Raritan Basin (Belvidere to Spruce Run). In this plan Round Valley Reservoir would be used to store flood flows diverted from Delaware River for the water supply use in the Northeastern Region. A diversion dam would be constructed on the Delaware above Belvidere and a gravity tunnel constructed between Belvidere and Spruce Run along the route described under Plan DG-3. This would be a 15-foot diameter, concrete-lined tunnel with a capacity of 750 mgd, and a

length of about 14 miles. It would discharge into Spruce Run, a tributary of South Branch of Raritan River a few miles above the site for the Hamden pumping plant, and the natural channel would be used to convey the water generally to the Bound Brook pumping and treatment plant. The plan includes construction of a pumping plant on the South Branch of Raritan River at Hamden to pump excess Delaware River water into the Round Valley Reservoir for storage. This plant would have a rated capacity of 450 mgd and an installed capacity of 565 mgd. It would have to pump through force mains about 3.4 miles long against a static head of 255 feet. Round Valley Reservoir would be developed to a flow line elevation of 415 feet, would have a flooded area of 2,530 acres and store 76.0 billion gallons of water. Water would be released from this reservoir to flow down the natural channels of Prescott Brook, South Branch of Raritan River and Raritan River to Bound Brook where it would be diverted, treated, and pumped into the supply mains in the same way as included in other development plans. If desired, a gravity-type conduit could be constructed from Round Valley to the Bound Brook pumping plant in lieu of using the natural channels for this flow conveyance. The estimated capital cost would be \$138,260,000 and the annual charges \$8,804,000.

47. One of the principal results of this survey of water resources development in New Jersey was the passage of the New Jersey Water Supply Law of 1958, as Title 58, Chapter 1, Revised Statutes. This law authorized the State, subject to referendum approval, to provide the initiative and foresight essential to the maximum conservation, protection and equitable allocation of its surface and subsurface water resources. Under the broad provisions of this law the New Jersey Department of Conservation and Economic Development, in February 1958, engaged the engineering firm of Whitman, Requardt and Associates to investigate and report on the Spruce Run-Round Valley Project in the Raritan River basin to supply additional water to northeastern New Jersey. This report was submitted 20 August 1958 and contains a recommendation that the Round Valley Reservoir be so constructed that in the future it may be raised to store about 55 to 75 billion gallons of water to be diverted from the Delaware River. This report has been approved by the State of New Jersey and construction has been undertaken on the Spruce Run portion of this project.

48. Report on the Effect of Ship Channel Enlargement above Philadelphia.

In May 1953 the Committee for the Study of the Delaware River engaged consultants to make an investigation of the Delaware River and the ground water conditions in the areas of New Jersey and Pennsylvania adjacent to the river. The purpose of the investigation was to determine the extent of river water infiltration into aquifers and whether the quality and quantity of the ground water supplies would be affected by the then proposed widening and deepening of the ship channel between Philadelphia and Trenton.

49. The Committee was composed of the then Mayors of the municipalities of Camden, Riverton and Woodbury, N. J., and individuals representing the American Water Works Service Company, Inc., the Campbell Soup Company and the U. S. Steel Corporation. The consultants were Sheppard T. Powell, Consulting Engineer, and Leggette & Brashears, Consulting Ground-Water Geologists. The portion of the investigation relating to river water quality and appraisal of its effect upon ground water in adjacent areas was assigned to Mr. Powell. That portion of the study related to ground water was assigned to Leggette & Brashears, and it dealt with the extent and effect of river recharge on the underground supplies at different sites along the river.

50. The consultants submitted their report to the Committee in May 1954. The report contains details on the investigation made and a summary of the conclusions reached. In his "Summary of Findings" Mr. Powell states, in part, that

"The investigation shows that enlarging the channel will not increase present low chlorinities at Philadelphia and above. It will, in fact, add to the storage of fresh water and thereby decrease chlorides in the upper river."

Mr. Powell's "General Conclusion" reads as follows:

"In summary, it is concluded that the quality of the ground water in New Jersey will not be damaged by enlargement of the channel above Philadelphia."

Leggette & Brashears concluded that

"Increasing the depth of the channel will expose more of the highly permeable stratified zones of the aquifers, thereby producing a greater area across the bedding planes for infiltration.

"The increase in river infiltration which will result from the proposed channel enlargement will also increase the influence of the river on the temperature and chemical quality of water in the adjacent aquifers. So long as the chemical quality of the river is better than that of the ground water, the results will be beneficial. However, if the total dissolved solids of the river water increases in future years, the channel enlargement will result in an increase in total dissolved solids of the ground water."

51. The conclusions drawn by the consultants from their investigations confirm those which the U. S. Army Engineer District, Philadelphia, drew from the studies it made in connection with its investigation of the feasibility of enlarging the navigation channel upstream from Philadelphia to Trenton. The report by the Engineer District on the studies for the navigation channel is dated 13 January 1953 and was published in House Document No. 358, 83d Congress, 2d Session.

52. Report on Water Resources Study of Brandywine Creek Basin in Pennsylvania.

In February 1958 the Secretary of the Pennsylvania Department of Forests and Waters authorized Bourquard, Geil and Associates, Consulting Hydraulic Engineers of Harrisburg, Pa., "to make an engineering study of the Brandywine Creek basin in Pennsylvania covering present and future water requirements, plans for augmenting present water supplies, and the advisability of providing flood control and recreational facilities and including the development of a comprehensive water resource program" for the basin. The water resources study was originally requested by the Brandywine Water Resources Committee, composed of representatives of the local governments, organizations and industries in the entire basin, lying in Delaware and Pennsylvania.

53. While the water supply features of the study undertaken by the Department of Forests and Waters were limited to the Pennsylvania portion of the basin, the flood control aspect studied by the U. S. Soil Conservation Service was for the entire Brandywine basin. One of the sponsoring agencies for the Watershed Work Plan, included in the overall plan for the Brandywine basin, is the Delaware State Soil Conservation Commission. Thus the plan for the Brandywine basin is a joint Federal-Interstate undertaking for the entire basin insofar as flood control is concerned.

54. The consultants submitted their report to the Secretary of the Department of Forests and Waters in December 1958. The report recommended a plan and a program of development. In November 1959 the consultants submitted a supplementary report which presented revisions in the plan. The plan of development recommended by the consultants consists of the projects summarized in table 2.

55. Reports by the U. S. Soil Conservation Service.

The U. S. Soil Conservation Service has prepared a number of reports for watershed projects in the Delaware River basin under the authority granted in Public Law 566. One of these projects, that for Pequest River, described in a report dated 24 August 1955,



**EXHIBIT C - TABLE 2**  
**BRANDYWINE CREEK BASIN - PLAN FOR DEVELOPMENT OF WATER RESOURCES**  
**SUMMARY OF PROJECTS**

Project	Drainage Area Controlled (sq.mi.)	Storage Allocation (Acre-Feet)					Total Storage (ac.ft.)	Project Cost 3/
		Flood Control	Water Supply	Recreation & Conservation	Fish & Wildlife Development	Sedimentation		
WEST BRANCH								
F&W-SCS Reservoir No. WA-7 1/	20.2	4,040	14,600	2,700			21,340	\$ 4,613,900
F&W Reservoir No. WA-5A	4.1		1,575	525			2,100	1,053,400
F&W Reservoir No. WA-2	4.5		3,000	600			3,600	1,330,900
SCS Reservoir No. 1	3.1	650				36	686	121,800
SCS Reservoir No. 1B	1.5	294				18	312	237,300
SCS Reservoir No. 2A	4.4	900				53	953	232,900
F&W-SCS Reservoir No. WA-15*	---	900	2,115	425			3,440	2,152,300
Sucker Run Channel Improvement								
Project - SCS	3.1							921,200
West Branch Sub-Total	40.9	6,784	21,290	4,250		107	32,431	\$10,663,700
EAST BRANCH								
F&W-SCS Reservoir No. DO-8A	20.2	4,040	5,040	800			9,880	\$ 2,700,400
SCS-PFC Reservoir No. 6 2/	3.1	605			939	36	1,580	163,800
SCS Reservoir No. 11	1.2	231				14	245	60,100
SCS Reservoir No. 12	1.7	357				20	377	44,000
SCS Reservoir No. 5A	11.9	2,160				140	2,300	400,300
SCS-PFC Reservoir No. 5	3.1	1,024			940	36	2,000	111,200
East Branch Sub-Total	41.2	8,417	5,040	800	1,879	246	16,382	\$ 3,479,800
TOTAL	82.1	15,201	26,330	5,050	1,879	353	48,813	\$14,143,500

\*This project is a modification of SCS Reservoir No. 2A.

<sup>1/</sup> F&W denotes Pennsylvania Department of Forests & Waters.

SCS denotes Soil Conservation Service.

<sup>2/</sup> PFC denotes Pennsylvania Fish Commission.

<sup>3/</sup> Based on November 1959 price levels.

has been completed. The other projects, which have been approved by the Department of Agriculture for development, are described in the following reports:

<u>Watershed</u>	<u>Date of Report</u>
Green-Dreher (Wallenpaupack Cr.)	31 August 1959
Lackawaxen River	8 May 1958
Little Schuylkill River	25 July 1958
Paulins Kill	10 November 1958
Town Bank (Salem Co., N.J.)	5 May 1959

APPENDIX A  
HISTORY OF INVESTIGATION

EXHIBIT D  
AMENDED DECREE OF SUPREME  
COURT OF THE UNITED STATES  
RE DELAWARE RIVER DIVERSION

APPENDIX A - HISTORY OF INVESTIGATION

AMENDED DECREE OF THE SUPREME COURT  
OF THE UNITED STATES RE  
DELAWARE RIVER DIVERSION  
(Ordered June 7, 1954)

The Court, having considered the amended petition of the City of New York, joined by the State of New York, to which is appended the consent of the State of New Jersey, the answer filed by the State of New Jersey seeking affirmative relief and the answers filed by the Commonwealth of Pennsylvania and the State of Delaware, the evidence and exhibits adduced by the parties, the report of Kurt F. Pantzer, Esquire, Special Master, and statements from all the parties addressed to the Court expressing the intention of the parties not to file exceptions or objections to the report, and being fully advised in the premises, now enters the following order:

I. REPORT OF SPECIAL MASTER APPROVED. The "Report of the Special Master Recommending Amended Decree," filed May 27, 1954, is in all respects approved and confirmed.

II. 1931 DECREE SUPERSEDED. The decree of this Court entered May 25, 1931 (283 U. S. 805) is modified and amended as hereinafter provided and, upon the entry of this amended decree, the provisions of the decree of May 25, 1931, shall be of no further force and effect.

III. DIVERSIONS BY THE CITY OF NEW YORK ENJOINED EXCEPT AS HEREIN AUTHORIZED. The State and City of New York are enjoined from diverting water from the Delaware River or its tributaries except to the extent herein authorized and upon the terms and conditions herein provided.

A. Authorized Diversions.

1. 440 M. G. D. The City of New York may divert from the Delaware River watershed to its water supply system the equivalent of 440 million gallons daily (m. g. d.) until the City completes and places in operation its reservoir presently under construction on the East Branch of the Delaware River.

2. 490 M. G. D. After the completion and commencement of operation of the East Branch reservoir, the City may divert the equivalent of 490 m. g. d. until the completion of its proposed dam and reservoir at Cannonsville on the West Branch of the Delaware River, provided, however, that in the event of an abnormal or unforeseeable interruption of its facilities, the City may divert in excess of the equivalent of 490 m. g. d. to meet its emergency requirements, but in no event shall such diversion impair the obligation of the City to make the releases hereinafter specified.



3. 800 M. G. D. After the completion of the Cannonsville reservoir, the City may divert the equivalent of 800 m. g. d.

4. Computation of Diversion. At no time during any twelve-month period, commencing June 1, shall the aggregate total quantity diverted, divided by the number of days elapsed since the preceding May 31, exceed the applicable permitted rate of diversion.

B. Conditions and Obligations Imposed in Connection With Diversions and Releases by City. The diversions and releases by the City of New York from the Delaware River shall be made under the supervision and direction of the River Master, hereinafter appointed, and shall be subject to the following conditions and obligations:

1. Compensating Releases - The Montague Formula. The City shall release water from its reservoirs as follows:

(a) Until the East Branch reservoir is completed and placed in operation, on the day following each day in which the average flow in the Delaware River falls short of 0.50 cubic feet per second per square mile (c. s. m.), either at Montague, New Jersey (below the mouth of the Neversink River), or at Trenton, New Jersey (0.50 c. s. m. being equivalent to a flow of 1740 cubic feet per second (c.f.s.) at Montague and 3400 c.f.s. at Trenton), the City shall release water from the Neversink reservoir at an average of 0.66 c.s.m. or 61.38 c.f.s.

(b) Upon the completion and placing in operation of the Neversink and East Branch reservoirs, the City shall release water from one or more of its storage reservoirs in the upper Delaware watershed. Such releases shall be in quantities designed to maintain a minimum basic rate of flow at the gaging station of the United States Geological Survey (U. S. G. S.) at Montague of 1525 c.f.s. (985.6 m.g.d.) until the Cannonsville project is completed and its reservoir first filled to the extent that 50 billion gallons above the lowest outlet are available for diversion and release, and of 1750 c.f.s. (1131.1 m.g.d.) thereafter. Compliance by the City with directions of the River Master with respect to such releases shall be considered full compliance with the requirements of this subsection (b).

(c) At the commencement of the calendar year following the completion and placing in operation of the Neversink and East Branch reservoirs and of each calendar year thereafter, the City of New York shall estimate and report to the River Master the anticipated consumption of water during such year to be provided for by the City from all its sources of supply. The City shall, as hereinafter provided, release in the aggregate from all its storage reservoirs in the upper Delaware watershed, in addition to the quantity of water required to be released for the purpose of maintaining the then applicable minimum basic rate of flow as hereinabove provided, a quantity of water equal

to 8 per cent of the amount by which the estimated consumption during such year is less than the City's estimate of the continuous safe yield during such year of all its sources obtainable without pumping. In any such year the City's estimate of anticipated consumption shall not exceed by more than 7½ billion gallons the actual consumption in any previous calendar year; and its safe yield in any such year, obtainable without pumping, shall be estimated at not less than 1355 m.g.d. after the Neversink and East Branch reservoirs are put into operation; and at not less than 1665 m.g.d. after the Cannonsville reservoir is put into operation. If, at any time after the completion of the Cannonsville reservoir and prior to the year 1993, the continuous net safe yield for water supply of all of the City's sources of water supply, obtainable without pumping, is increased by the development of additional sources, such greater safe yield shall be used in determining the excess releases.

(d) The City of New York shall release the excess quantity provided for in subsection (c) at rates designed to release the entire quantity in 120 days. Commencing with the fifteenth day of June each year, the excess releases shall continue for as long a period, but not later than the following March 15, as such additional quantity will permit. Such period is hereinafter referred to as the "seasonal period." The excess quantity required to be released in any seasonal period shall in no event exceed 70 billion gallons. In releasing the excess quantity specified for any seasonal period, the City shall not be required to maintain a flow at Montague greater than the applicable minimum basic rate plus the excess quantity divided by 120 days, or in any event greater than 2650 c.f.s., nor to release at rates exceeding the capacity of its release works. The City shall in each seasonal period continue its excess releases until March 15 or until the aggregate quantity of the flow at Montague in excess of the basic rate or in excess of such higher rates as are not the result of the City's prior releases, is equal to the total specified excess quantity.

(e) The terms and conditions provided in subsections (b), (c) and (d) hereof shall continue to be applicable in all respects in the event that the U. S. G. S. gaging station at Montague shall be relocated at a point below the confluence of the Neversink River with the Delaware River.

2. Minimum Capacity of Release Works at Reservoirs of City. In constructing the Cannonsville reservoir, the City shall install release works of such capacity as will provide a minimum aggregate release capacity from all its reservoirs in the Delaware River watershed of not less than 1600 c.f.s. under conditions of maximum reservoir depletion.

3. Releases to be Continued in Spite of Interference. In the event that any works hereafter constructed by public or private interests in the watershed of the Delaware River outside of the State of New

York shall prevent the proper operation of the U.S.G.S. gaging station at Montague or interfere with the effective operation of the above release requirements by diverting water past the station or by intercepting the natural flow and storing it in reservoirs with an aggregate storage capacity in excess of 25 billion gallons, the City of New York shall continue to make the releases above specified which would be required in the absence of such interference, and appropriate gaging stations shall be established for that purpose.

4. Inspection Permitted. The States of New Jersey and Delaware and the Commonwealth of Pennsylvania, through accredited representatives, and the River Master, shall at all reasonable times have the right to inspect the dams, reservoirs and other works constructed by the City of New York, to inspect the diversion areas and the inflow, outflow and diverted flow of such areas, to inspect the meters and other apparatus installed by the City of New York and to inspect all records pertaining to inflow, outflow and diverted flow.

IV. TREATMENT OF PORT JERVIS SEWAGE. The effluent from the sewage treatment plant at the City of Port Jervis, New York, shall be treated so as to effect a reduction of 85 per cent in the organic impurities and shall be treated with a chemical germicide, or otherwise, so that the B. coli originally present in the sewage shall be reduced by 90 per cent. Untreated industrial waste from plants in the City of Port Jervis shall not be allowed to enter the Delaware and Neversink Rivers. The treatment of such industrial wastes shall be such as to render the effluent practically free from suspended matter and non-putrescent. The treatment of both sewage and industrial waste shall be maintained so long as any diversion is made from the Delaware River or its tributaries.

V. DIVERSIONS BY NEW JERSEY AUTHORIZED UNDER SPECIFIED CONDITIONS.

A. Authorized Diversions. The State of New Jersey may divert outside the Delaware River watershed, from the Delaware River or its tributaries in New Jersey, without compensating releases, the equivalent of 100 m.g.d., if the State shall not, prior to July 1, 1955, repeal Chapter 443 of the New Jersey Laws of 1953, and if, when the Commonwealth of Pennsylvania accepts the conditions as specified in Section 19 of that Chapter, the State of New Jersey shall join with the Commonwealth of Pennsylvania in requesting the consent of Congress to the agreement embodied in Chapter 443 of the New Jersey Laws of 1953 and an Act of the Commonwealth of Pennsylvania accepting the conditions of such New Jersey Act.

B. Conditions and Obligations Imposed in Connection with Diversions by New Jersey. The diversions by New Jersey from the Delaware River shall be made under the supervision of the River Master and shall be subject to the following conditions and obligations:

1. Until the State of New Jersey builds and utilizes one or more reservoirs to store waters of the Delaware River or its tributaries for the purpose of diverting the same to another watershed, the State may divert not to exceed 100 m.g.d. as a monthly average, with the diversion on any day not to exceed 120 million gallons.

2. If and when the State of New Jersey has built and is utilizing one or more reservoirs to store waters of the Delaware River or its tributaries for the purpose of diversion to another watershed, it may withdraw water from the Delaware River or its tributaries into such impounding reservoirs without limitation except during the months of July, August, September and October of any year, when not more than 100 m.g.d. as a monthly average and not more than 120 million gallons in any day shall be withdrawn.

3. Regardless of whether the State of New Jersey builds and utilizes storage reservoirs for diversion, its total diversion for use outside of the Delaware River watershed without compensating releases shall not exceed an average of 100 m.g.d. during any calendar year.

VI. EXISTING USES NOT AFFECTED BY AMENDED DECREE. The parties to this proceeding shall have the right to continue all existing uses of the waters of the Delaware River and its tributaries, not involving a diversion outside the Delaware River watershed, in the manner and at the locations presently exercised by municipalities or other governmental agencies, industries or persons in the Delaware River watershed in the States of New York, New Jersey and Delaware and the Commonwealth of Pennsylvania.

#### VII. RIVER MASTER.

A. Designation. Subject to the concurrence of the Director of the U. S. Geological Survey, the Chief Hydraulic Engineer of the U. S. Geological Survey, or such other engineer of the U. S. Geological Survey as shall at any time be designated by the Chief Hydraulic Engineer, is hereby designated as River Master.

B. Duties. The River Master shall either in person or through his assistants possess, exercise and perform the following duties and functions:

##### 1. General Duties.

(a) Administer the provisions of this decree relating to yields, diversions and releases so as to have the provisions of this decree carried out with the greatest possible accuracy;

(b) Conserve the waters in the river, its tributaries and in any reservoirs maintained in the Delaware River watershed by the City



of New York or any which may hereafter be developed by any of the other parties hereto;

(c) Compile and correlate all available data on the water needs of the parties hereto;

(d) Check and correlate the pertinent stream flow gagings on the Delaware River and its tributaries;

(e) Observe, record and study the effect of developments on the Delaware River and its tributaries upon water supply and other necessary, proper and desirable uses; and

(f) Make periodic reports to this Court, not less frequently than annually, and send copies thereof to the Governors of Delaware, New Jersey, New York and Pennsylvania, and to the Mayor of the City of New York.

2. Specific Duties with Respect to the Montague Release Formula. In connection with the releases of water which the City of New York is required to make under Par. III-B-1(b) of this decree, the River Master, in cooperation with the City of New York, shall, by appropriate observation and estimates, perform the following duties:

(a) Determine the average times of transit of the flow between the release works of the several reservoirs of the City and Montague and between the release works of other storage reservoirs in the watershed and Montague;

(b) Make a daily computation of what the average flow observed on the previous day at Montague would have been, except for that portion previously contributed by releases of the City or as affected by the contributing or withholding of water at other storage reservoirs, for the purpose of computing the volume of water that would have had to be released in order to have maintained precisely the basic rate on that day;

(c) Take account of all changes that can be anticipated in the flow from that portion of the watershed above Montague not under the City's control and allow for the same by making an appropriate adjustment in the computed volume of the daily release; and

(d) After taking into consideration (a), (b) and (c), direct the making of adjusted daily releases designed to maintain the flow at Montague at the applicable minimum basic rate.

C. Distribution of Costs. The compensation of, and the costs and expenses incurred by, the River Master shall be borne equally by the State of Delaware, State of New Jersey, Commonwealth of Pennsylvania, and the City of New York.

D. Replacement. In the event that for any reason the Chief Hydraulic Engineer of the U. S. G. S. or his designee cannot act as River Master, this Court will, on motion of any party, appoint a River Master and fix his compensation.

VIII. NO PRIOR APPROPRIATION NOR APPORTIONMENT. No diversion herein allowed shall constitute a prior appropriation of the waters of the Delaware River or confer any superiority of right upon any party hereto in respect of the use of those waters. Nothing contained in this decree shall be deemed to constitute an apportionment of the waters of the Delaware River among the parties hereto.

IX. DECREE WITHOUT PREJUDICE TO THE UNITED STATES. This decree is without prejudice to the United States. It is subject to the paramount authority of Congress in respect to commerce on navigable waters of the United States; and it is subject to the powers of the Secretary of the Army and Chief of Engineers of the United States Army in respect to commerce on navigable waters of the United States.

X. RETENTION OF JURISDICTION; NO ESTOPPEL. Any of the parties hereto, complainant, defendants or intervenors, may apply at the foot of this decree for other or further action or relief, and this Court retains jurisdiction of the suit for the purpose of any order or direction or modification of this decree, or any supplemental decree that it may deem at any time to be proper in relation to the subject matter in controversy. The fact that a party to this cause has not filed exceptions to the report of the Special Master or to the provisions of this decree shall not estop such party at any time in the future from applying for a modification of the provisions of this decree, notwithstanding any action taken by any party under the terms of this decree.

XI. COSTS OF THIS PROCEEDING. The costs of this proceeding shall be paid by the parties in the following proportions: State of New Jersey, 26-2/3 per cent, City of New York, 26-2/3 per cent, State of New York, 10 percent, Commonwealth of Pennsylvania, 26-2/3 per cent, and State of Delaware, 10 per cent.

APPENDIX A  
HISTORY OF INVESTIGATION

EXHIBIT E  
PROCEDURAL PLAN FOR SURVEY  
OF THE DELAWARE RIVER BASIN  
WATER RESOURCES

APPENDIX A  
HISTORY OF INVESTIGATION

EXHIBIT F  
DELAWARE RIVER BASIN  
ADVISORY COMMITTEE



## APPENDIX A - HISTORY OF INVESTIGATION

### DELAWARE RIVER BASIN ADVISORY COMMITTEE

1. The Governor of Pennsylvania on 19 July 1955 sent letters to the Governors of New York, New Jersey, and Delaware, and to the Mayors of Philadelphia and New York City, recommending that a Delaware River Survey Commission be formed to investigate the water resources of the Delaware River basin. The following month Hurricane Diane produced a great flood in the Delaware River basin on 18-19 August. Shortly thereafter Congressional Committees adopted resolutions which requested the Corps of Engineers, U. S. Army, to conduct a comprehensive survey of water resources and prepare a report for their overall development. This Congressional action eliminated the need for the States and cities to make a survey and it provided them the opportunity to cooperate in the Federal undertaking.

2. The group accepted this opportunity and in March 1956 changed the name of the Commission to that of "Delaware River Basin Advisory Committee." In August 1956 this committee was officially reconstituted as an advisory committee by the issuance of the following directive signed by the four Governors and the two Mayors:

#### DIRECTIVE TO THE DELAWARE RIVER BASIN ADVISORY COMMITTEE

Joseph S. Clark, Jr. . . . .	Appointee of Mayor Richardson Dilworth
Irving V. A. Huie . . . . .	Appointee of Mayor Robert F. Wagner, Jr.
James Kerney, Jr. . . . .	Appointee of Governor Robert B. Meyner
Norman M. Lack . . . . .	Appointee of Governor J. Caleb Boggs
John P. Robin . . . . .	Appointee of Governor George M. Leader
Thorndike Saville . . . . .	Appointee of Governor Averell Harriman

Gentlemen:

Having undertaken at our request to re-examine and evaluate the water and related land resource problems of the Delaware River Basin, you are hereby constituted the Delaware River Basin Advisory Committee.

We ask that you give your attention to the collection and evaluation of existing and newly-developing information about water and related land resources of the Delaware River Basin, cooperate closely with other agencies making studies in relation thereto, assist in setting up and obtaining financing for new studies and research which are needed for the completion of a comprehensive, multiple-purpose plan, obtain the review and advice of the best technical experts available on all major aspects of the planning work, help in the final formulation of such a plan, aid in the marshalling and dissemination of information necessary for adequate public understanding of the subject, assist in keeping local governments of the Basin advised and alerted to their interests, report to us from time to time as the planning progresses, and make recommendations to us on fundamental questions of policy relating to the plan and means of carrying out the developments provided for in the plan.

You are authorized to set up an office and staff within funds made available by the participating governments, and to seek funds and services from non-profit organizations, and to develop such organization as may be required to perform these tasks. In carrying out this directive it shall be understood that you shall recognize and accept those Delaware River Basin water supply projects presently constructed or under construction.

We request that the Committee function in these regards only until the task of replanning the water and related land resources of the Delaware River Basin has been completed and an appropriate program of development recommended to the governments involved.

Signed,

/s/ J. Caleb Boggs  
Governor of Delaware

/s/ Robert B. Meyner  
Governor of New Jersey

/s/ Averell Harriman  
Governor of New York

/s/ George M. Leader  
Governor of Pennsylvania

/s/ Robert F. Wagner  
Mayor of New York City

/s/ Richardson Dilworth  
Mayor of Philadelphia

August, 1956

APPENDIX A  
HISTORY OF INVESTIGATION

EXHIBIT G  
COORDINATION DIRECTIVES

## APPENDIX A - HISTORY OF INVESTIGATION

### COORDINATION DIRECTIVES

1. Responsibility for the comprehensive investigation of the water resources of the Delaware River basin and the formulation of a plan for their development was delegated by the Chief of Engineers, U. S. Army, to the District Engineer, U. S. Army Engineer District, Philadelphia. The District Engineer sought the full cooperation of the States, municipalities, and Federal agencies responsible for the functions and activities to be embraced in the plan, in order that the plan would be in full accord with the recommendations of the Presidential Advisory Committee on Water Resources Policy. The letters contained in this exhibit established the basis for the cooperation of these agencies.

2. The following letter outlined the type of cooperative effort proposed by the Department of the Army for this investigation:

DEPARTMENT OF THE ARMY  
Office of the Assistant Secretary  
Washington 25, D. C.

11 September 1956

Honorable Clarence A. Davis  
Under Secretary of Interior  
Washington, D. C.

Dear Mr. Davis:

As you know the Corps of Engineers of the Department of the Army has been authorized and directed to develop a comprehensive plan for the Delaware River Basin. The task of formulating this plan was delegated to the District Engineer at Philadelphia and he has sought the



Letter to Honorable Clarence A. Davis

cooperation of the States, interstate organizations, and the Federal agencies responsible for the functions and activities to be embraced by the plan. It is believed that in concept the plan which will result from this cooperative effort will be in full accord with the recommendations of the Presidential Advisory Committee on Water Resources Policy. Moreover, the development of the plan by cooperative action is in harmony with the basic principle laid down by that Committee. The organization of the work necessarily differs from that proposed by PACWRP for the reason that the "Coordinator of Water Resources" and the regional "Water Resources Committee" have not yet been established, and also because--for this particular undertaking--primary responsibility has been placed upon the Corps of Engineers. Pending the full implementation of the PACWRP recommendations by the Congress it seems to us that we have gone about as far as it is possible to go in following the course mapped out by that Committee.

I am informed that field representatives of your Department have expressed some apprehension as to the role they are expected to play in the undertaking and as to the use to be made of their reports. The purpose of this letter is to outline for you the basis on which the Corps of Engineers seeks the cooperation of other agencies. It is my hope that this will eliminate any misunderstandings which may have arisen.

First let me say that in carrying out its assignment the Corps of Engineers conceives of its position as being mainly that of a coordinator in the development of a plan which will encompass many functions and activities not within this Department's sphere of authority. In fact, it is probable that a major part of the plan will be carried out by non-Federal interests, or by Federal agencies other than the Corps.

With this concept in mind the District Engineer is arranging for the cooperation of states and other agencies on the following basis:

1. Federal agencies normally responsible for those functions and activities of the Federal government to be embraced by the plan will be invited to cooperate in its preparation. Arrangements for such participation shall be in accord with the following:

- a. The Corps of Engineers will invite other Federal agencies to develop those segments of the over-all plan falling within the fields for which those agencies bear the primary Federal responsibility.

- b. While the Corps of Engineers will make the assignments to the cooperating Federal agencies it will expect those agencies to assume full responsibility for carrying out these assignments, and for the reports and recommendations resulting therefrom.

Letter to Honorable Clarence A. Davis

c. The reports of the cooperating agencies will accompany the final report of the Corps of Engineers, and the recommendations of those agencies will be at least summarized in the body of that report.

d. To the extent necessary to bring about the development of a coordinated and harmonious basin plan, to resolve differences between various agencies and interests, or to take into account the views of the States, the Corps of Engineers may in its final report make recommendations at variance with those of a cooperating Federal agency. In such an event the report will indicate the difference between the recommendation of the Corps of Engineers and that of the cooperating agency.

e. The Corps of Engineers will provide funds to cooperating Federal agencies for carrying out such parts of the work assigned them as these agencies would not otherwise undertake during the planning period.

f. Memoranda of understanding will be developed at field level between the Corps of Engineers and each cooperating Federal agency when considered necessary by either party.

2. The States of the Delaware Basin will be invited to cooperate directly with the Corps of Engineers in developing the over-all plan. Each Federal cooperating agency may also invite State cooperation within the scope of that agency's assignment.

3. For the purpose of resolving problems of mutual interest to several Federal agencies or Federal agencies and States a coordinating committee will be established at the field level with the representative of the Corps of Engineers as Chairman.

I wish it to be clear that we consider the arrangements proposed by PACWRP superior to these we have made for the Delaware planning project. Yet we would not favor putting the PACWRP proposals only partially into effect by establishing for the Delaware Basin an inter-agency committee of the type utilized in the development of the New England - New York Inter-Agency Committee Report. Moreover, we would doubt the advisability of establishing a water resources committee of the kind recommended by PACWRP for a region as small as the Delaware River Basin. I hope, therefore, that it will be possible for the agencies of the Department of Interior as well as other Federal agencies and the states to continue their cooperation on the basis outlined above.

Letter to Honorable Clarence A. Davis

If there is any further step we might take to assure mutual understanding and whole-hearted cooperation in this important undertaking, I trust you will bring it to my attention.

Sincerely yours,

/s/ George H. Roderick  
Assistant Secretary of the Army (CMA)

3. The following letter, from the President of the United States to the Secretary of the Army, outlined the President's desire for full cooperation and formed the basis for establishment of the Delaware Basin Survey Coordinating Committee.

THE WHITE HOUSE  
WASHINGTON

October 22, 1956

Dear Mr. Secretary:

The Corps of Engineers of the Department of the Army has undertaken a comprehensive survey of the Delaware River Basin under authority vested in it by law. An appropriation of \$500,000 has been made available for this purpose during the 1957 fiscal year.

As you know, such Federal agencies as the Departments of the Interior, Agriculture, Commerce, Health, Education and Welfare, and Labor and the Federal Power Commission are deeply concerned with the comprehensive development of the water and related land resources of the Delaware River Basin. Similarly, the States of Pennsylvania, New York, New Jersey and Delaware, as well as the cities of New York and Philadelphia, have a direct and longstanding interest in any plans for development which may emerge from the survey. In fact, it is probable that a major part of any comprehensive plan for the Delaware River Basin will be carried out by non-Federal interests, or by Federal agencies other than the Department of the Army.

I am, therefore, asking that the Department of the Army exercise particular care throughout the survey and in the preparation of the survey report to solicit and take into account the comments and views of the Federal agencies and the affected States and municipalities. I have in mind more than the customary circularization of completed reports as now required by law and by executive orders. I desire that your Department, through the officers responsible for the direction of the survey, establish arrangements and procedures which will assure a

full and continuing exchange of views and information among the parties concerned. Every effort should also be made to utilize the technical resources of the Federal agencies and the State and local governments in the assembly and evaluation of data pertinent to the comprehensive survey.

The Department of the Army and the Corps of Engineers should feel free to invite the representatives of Federal agencies and non-Federal public instrumentalities to participate in coordinating committees or advisory groups. I believe that it would be desirable to supplement other procedures for interagency cooperation with regular meetings at which Federal, State and municipal representatives can review progress and discuss problems of general interest.

I am sending copies of this letter to the Secretaries of the Interior, Agriculture, Commerce, Labor, and Health, Education and Welfare and the Chairman of the Federal Power Commission, and am asking them to render all possible assistance to the Department of the Army in order that the full resources of the Federal Government may be utilized in this survey. You are requested to inform the governors of the four Delaware Basin States and the mayors of New York City and Philadelphia of the contents of this letter.

Sincerely,

/s/ DWIGHT D. EISENHOWER

The Honorable Wilbur M. Brucker  
The Secretary of the Army  
Washington 25, D. C.

4. The following letter outlining the functions of the Coordinating Committee was sent to the Secretaries of the Departments of the Interior, Agriculture, Commerce, Labor, and Health, Education, and Welfare, and the Chairman of the Federal Power Commission, as well as to the Governors of the States of New York, New Jersey, and Delaware, and the Commonwealth of Pennsylvania, and the Mayors of Philadelphia and the City of New York:



DEPARTMENT OF THE ARMY  
Office of The Assistant Secretary  
Washington 25, D. C.

ENGWD

12 January 1957

The Honorable

The Secretary of Commerce

Dear Mr. Secretary:

I refer to the President's letter of 22 October 1956, addressed to the Secretary of the Army, a copy of which was furnished you, regarding the comprehensive survey of the Delaware River Basin and particularly the coordination and cooperation among Federal and State agencies engaged in preparation of that report. In his letter the President indicated that he desired that this department establish arrangements and procedures which will assure a full and continuing exchange of views and information among the parties concerned.

In accordance with the desires of the President, it is proposed to form a coordinating committee on the Delaware Basin Survey consisting of one representative each from the Departments of Interior, Agriculture, Commerce, Labor, and Health, Education, and Welfare, and from the Federal Power Commission; one representative from each of the four states concerned, Delaware, Pennsylvania, New Jersey and New York; and one representative each from the cities of New York and Philadelphia. The Corps of Engineers' representative will be the District Engineer, Philadelphia District, who will act as chairman of the committee.

The main functions of the coordinating committee will be to make periodic examinations of the progress being made in the various studies, to discuss problems of mutual interest, and to assist and advise all participating agencies. It is realized that some departments will have several participating services and bureaus, but in order to keep the committee to reasonable size it seems preferable to limit membership to one for each department. In addition to this coordinating committee, work groups and advisory committees will be formed by representatives of the various agencies and bureaus at the field level as appears necessary and advisable.

I trust that you are in accord with this procedure and that you will designate, as soon as convenient, a representative from your department to serve on this coordinating committee.

Sincerely yours,

/s/ George H. Roderick  
Assistant Secretary of the Army (CMA)

APPENDIX A  
HISTORY OF INVESTIGATION

EXHIBIT H  
ACCELERATED STUDY  
TOCKS ISLAND SITE

APPENDIX A - HISTORY OF INVESTIGATION

ACCELERATED STUDY - TOCKS ISLAND SITE

1. The Pennsylvania Joint Committee to Study and Examine Various Plans Developed for the Distribution of Water from the Delaware River held a meeting in Harrisburg, Pennsylvania, on 31 January 1956. At the meeting the Chairman, the late Senator Joseph J. Yosko, requested the U. S. Army Engineer District, Philadelphia, to make an accelerated study of a dam site on the main stem of the Delaware River at Tocks Island. This accelerated study was completed and transmitted to the Governor of Pennsylvania in the following letter:

CORPS OF ENGINEERS, U. S. ARMY  
Office of the District Engineer  
PHILADELPHIA DISTRICT  
2635 Abbottsford Ave.  
PHILADELPHIA, PA.

NAPDV

6 February 1957

Honorable George M. Leader  
Governor, Commonwealth of Pennsylvania  
Harrisburg, Pennsylvania

Dear Governor Leader:

I refer to the meeting of the Joint Committee to Study and Examine Various Plans Developed for the Distribution of Water from the Delaware River held at Harrisburg on 31 January 1956. Senator Joseph J. Yosko is the Chairman of this committee. You were represented at the meeting by Dr. Maurice K. Goddard, Secretary of the Department of Forests and Waters. At that meeting it was agreed that this office would make an accelerated study of a dam site on the main stem of the Delaware River at Tocks Island. Later we received the following resolution adopted 20 February 1956 by the Committee on Public Works of the United States Senate:

NAPDV

6 February 1957

## Comparison Tocks Island and Wallpack Bend

"Resolved by the Committee on Public Works of the United States Senate, that the Board of Engineers for Rivers and Harbors, created under Section 3 of the Rivers and Harbor Act, approved June 13, 1902, be, and is hereby, requested to review the report of the Chief of Engineers on the Delaware River, N. Y., N. J., and Pa., contained in House Document, Numbered 179, Seventy-third Congress, Second Session, and other reports, in connection with the pending comprehensive survey of said stream with a view to determining the feasibility of construction and operation of a reservoir on the Main Stem of the Delaware River above Delaware Water Gap near Wallpack Bend or Tocks Island, on a cooperative basis by the United States and the Commonwealth of Pennsylvania and the State of New Jersey, as an integral unit of a comprehensive plan for the control and utilization of the water resources of the Delaware River in the interest of flood control, navigation, water supply, stream pollution abatement, recreation, control of the movement of salt water, electric power, and other purposes."

The comprehensive survey of the water resources, as contemplated in the above resolution, was initiated early in 1956 and is actively under way at this time. Special attention has been given to early determination of the construction practicability of a reservoir on the Delaware River with a dam located either at Wallpack Bend or at Tocks Island. However, the economic feasibility of including such a unit, as part of a comprehensive plan for the development and use of the water resources of the Delaware River Basin, has not been determined, and is not determinable until near the close of this comprehensive survey.

Therefore this letter is limited to a discussion of the construction practicability of a dam and reservoir that could be constructed at the Tocks Island site; and a comparison of these structures with those previously proposed by Albright & Friel for the development of the Wallpack Bend site.

Location of Sites. The Tocks Island dam site has been selected in the narrow section of the Delaware River Valley near the upper end of Tocks Island and about seven miles above the Delaware River Water Gap. It is about eight miles downstream from the site selected by Albright & Friel for a development at Wallpack Bend. The locations of these sites are shown on Exhibit A, Location Map, as well as the extent of the reservoirs that would result from the construction of dams at these locations.



## Comparison Tocks Island and Wallpack Bend

Foundation Conditions of Tocks Island. A seismic survey and a preliminary geological investigation of the river valley in the vicinity of Tocks Island show that, from a physical stand-point, an earth-fill type dam can be constructed across the Delaware River near the upper end of Tocks Island, at the location shown on Exhibit A.

Preliminary Designs. A preliminary design has been made for an earth-fill type dam with a concrete spillway section on the right bank of the river for the Tocks Island dam site, and is sketched in Exhibit B. A combined concrete gravity-type dam and earth dike was proposed by Albright & Friel for the Wallpack Bend dam site in "Report to the Commonwealth of Pennsylvania Department of Forests and Waters on Wallpack Bend Dam and Reservoir on the Delaware River at Bushkill, Pennsylvania", dated 1 September 1955. An earth-fill dam appears to be better suited to the Tocks Island site. It must be recognized that the Tocks Island design is preliminary, and may be subject to major modifications at a later date as more detailed studies become available. A tabular comparison of the features of the two sites is given in Exhibit C.

Reservoir Design. The reservoir, formed by the Tocks Island Dam, was assumed to have the same nominal top elevation as that proposed by Albright & Friel for the Wallpack Bend Dam, namely elevation 420 feet above mean sea level. This reservoir would be about eight miles longer on the Delaware River due to the downstream location of the Tocks Island dam site. It would also extend about nine miles up the Flat Brook Valley (see Exhibit A). The total storage in this reservoir below a flat pool elevation of 420 feet is estimated at 635,000 acre-feet as compared to a total storage below the same pool elevation in Wallpack Bend Reservoir of 372,000 acre-feet. The Tocks Island Reservoir would require a limited amount of highway and utility relocations in addition to that required for Wallpack Bend Reservoir. It was estimated that 56,000 acre-feet would be required for inactive storage in the Tocks Island reservoir; 93,200 acre-feet were estimated by Albright & Friel for the Wallpack Bend reservoir. Hence the net effective storage at the two sites would be 579,000 acre-feet (189 billion gallons), and 279,000 acre-feet (91 billion gallons), respectively.

Fishway. Provision was made in the report by Albright & Friel for facilities to permit fish to pass over the Wallpack Bend Dam. No details are given in that report for this feature, except the inclusion of one and a half million dollars in the cost estimate for that dam. For the purposes of this preliminary comparison, it has been assumed that similar facilities would be needed and could be constructed at the Tocks Island dam site for the same cost.

## Comparison Tocks Island and Wallpack Bend

Hydroelectric Power. The report on Wallpack Bend dam and reservoir by Albright & Friel also discussed the possibility of constructing a power plant at some future date. The costs of constructing four penstocks through the dam, and temporary closures for them, apparently were included in the estimated costs for the dam and not in the estimate for the power plant. However, the layout of the Tocks Island dam is such that no provision need be made for the power installation at the time of construction. Therefore, no further consideration has been given to hydroelectric power in the comparison of the two sites.

State Parks. The report of Albright & Friel included an item of about \$1,448,000 for the provision of several State Parks on the right bank of the Wallpack Bend reservoir. It is believed that a similar development would be required in connection with the Tocks Island development.

Discussion. In order to compare the costs of construction at the two sites it was necessary to adjust the cost estimate presented by Albright & Friel to a common basis of comparison. From that estimate, which was based on August 1955 prices, were subtracted the costs of parks and the future power plant. These figures were then adjusted to correspond to December 1956 price levels. Similarly, but based on incomplete subsurface examinations and preliminary designs only, costs for construction at Tocks Island were developed, less any consideration of hydropower. These reveal that the dam, spillway and fishway at Tocks Island would cost about 5% to 10% more than the equivalent structures at Wallpack Bend. Comparing reservoir and relocation costs, less the costs for parks, reveals that the larger Tocks Island reservoir would cost 15% to 25% more than the one above Wallpack Bend. Comparing costs of effective storage, the cost per acre-foot for Tocks Island would be between 50% and 60% of the cost per acre-foot above Wallpack Bend.

Flooding conditions at Port Jervis, New York and Matamoras, Pa. will not be worsened by construction of either Wallpack Bend or Tocks Island dams if reservoir levels are established at nominal elevation 420 feet. In fact, increasing the reservoir level to a nominal elevation of 425 feet would not worsen natural flooding at these two towns. Such an increase in reservoir level would provide about 52,000 acre-feet of additional storage in Wallpack Bend, and 80,000 acre-feet in Tocks Island Reservoir; this is equivalent to increasing by 14% and 12.6%, respectively, the storage in these reservoirs.

More detailed studies are being made of the possibility of building the Tocks Island reservoir to a higher nominal elevation than 420 feet. Of course, raising the pool would increase costs; a higher dam

## Comparison Tocks Island and Wallpack Bend

would be slightly more expensive; real estate expenditures would be greater; and road relocation costs would rise. However, for these apparently low added costs, it is anticipated that considerable amounts can be added to the water resource potential of the Tocks Island site.

There are many considerations that must be taken into account before conclusions can be reached as to the economic feasibility of including this reservoir as an integral component in the pending comprehensive water resources plan. Some of these are the selection and evaluation of the other components required in such a plan; allocation of effective storage between several purposes for each component reservoir; the development of a coordinated operation plan for the whole; determination of the combined benefits from such operation; determination of the proportion of such benefits that would accrue from each component; and the determination of the relationship between benefits and costs for each component of the comprehensive plan, when the plan is operated as an integrated project for accomplishment of maximum benefits.

It is estimated that at least 18 months additional time will be required before the comprehensive water resources plan for the Delaware River Basin can be drafted. We cannot develop a coordinated operation plan for this basin at this time that would include a reservoir at Wallpack Bend or Tocks Island as an integral component. Likewise we cannot determine the benefits at this time that would accrue to such a reservoir from such operation. Any attempt to evaluate the benefits, likely to accrue from the operation of this reservoir as a single independent unit, would be both misleading and unfair to this reservoir.

Although the economic feasibility cannot be determined at this time, it appears that the Tocks Island dam site has a number of advantages over the Wallpack Bend site, as follows:

1. Tocks Island reservoir would have about twice the effective storage.
2. Costs per acre-foot of effective storage would be about 50% to 60% of the costs of development of the Wallpack Bend site.
3. The larger storage at Tocks Island is an asset of the site, of great value in this highly developed valley.

NAPDV

6 February 1957

Comparison Tocks Island and Wallpack Bend

4. The longer shoreline of Tocks Island reservoir would provide enhanced recreational opportunities.

Sincerely yours,

/s/ Allen F. Clark, Jr.

3 Incls 1/

1. Exhibit A - Location Map
2. Exhibit B - Sketch of  
Tocks Island Site
3. Exhibit C - Tabular Comparison

ALLEN F. CLARK, JR.  
Colonel, Corps of Engineers  
District Engineer

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1/ Exhibits A, B, and C, not included due to later changes in the features of this project.



APPENDIX A  
HISTORY OF INVESTIGATION

EXHIBIT I  
DELAWARE BASIN SURVEY COORDINATING COMMITTEE

DELAWARE BASIN SURVEY COORDINATING COMMITTEE

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Coordinating Committee

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## APPENDIX A - HISTORY OF INVESTIGATION

### DELAWARE BASIN SURVEY COORDINATING COMMITTEE

1. The President of the United States, by letter of 22 October 1956, directed that the Department of the Army exercise particular care throughout the survey and in the preparation of the survey report to solicit and take into account the comments and views of the Federal agencies and affected States and municipalities. A copy of this letter is contained in Exhibit G.

2. The District Engineer, U. S. Army Engineer District, Philadelphia, formally established the Delaware Basin Survey Coordinating Committee on 2 April 1957 to assure full compliance with the expressed desires of the President. The District Engineer has served as permanent chairman of this committee. Regular meetings of this committee have been held at about 3-month intervals at places and on dates as follows:

Atlantic City, New Jersey	2-3 April 1957
Bethlehem, Pennsylvania	15-16 August 1957
Wilmington, Delaware	14-15 November 1957
Philadelphia, Pennsylvania	27-28 February 1958
Honesdale, Pennsylvania	26-27 June 1958
New York City, New York	18-19 September 1958
Philadelphia, Pennsylvania	22-23 January 1959
Lake Harmony Pennsylvania	13-14 May 1959
Trenton, New Jersey	9 October 1959

3. Representatives appointed to this committee by the various agencies, States, and municipalities, and the dates of service of each of them are shown in table I. Minutes of each of the Committee Meetings, exclusive of their appendices, containing lists of attendance and technical papers presented, are included as part of this exhibit.

EXHIBIT I  
TABLE 1  
REPRESENTATIVES FORMING DELAWARE BASIN  
SURVEY COORDINATING COMMITTEE

<u>AGENCY REPRESENTED</u>	<u>COMMITTEE MEMBER</u>	<u>DATES OF SERVICE</u>	
		<u>From</u>	<u>To</u>
Department of the Army	Colonel Allen F. Clark, Jr. 1/	2 April 1957	15 November 1957
	Colonel W. F. Powers 1/	16 November 1957	31 March 1959
	Lt. Col. Frank A. Gerig, Jr. 1/	1 April 1959	30 June 1959
	Colonel T. H. Setliffe 1/	1 July 1959	-
Department of Agriculture	Mr. Fred H. Larson	1 March 1957	31 August 1957
	Mr. Alvin C. Watson	1 September 1957	-
Department of Commerce	Mr. S. L. Taylor	2 April 1957	30 September 1959
	Mr. August Schofer	1 October 1959	-
Department of Health, Education & Welfare	Mr. Sylvan C. Martin	2 April 1957	-
Department of the Interior	Mr. D. R. Gascoyne	16 February 1957	31 March 1959
	Mr. Mark Abelson ;	1 April 1959	-
Department of Labor	Mr. John F. Foy	2 April 1957	-
Federal Power Commission	Mr. John H. Spellman	2 April 1957	-
Commonwealth of Pennsylvania	Dr. Maurice K. Goddard	2 April 1957	-
State of Delaware	Mr. Richard A. Haber	2 April 1957	-
State of New Jersey	Mr. Joseph E. McLean	4 December 1956	31 July 1958
	Mr. Salvatore A. Bontempo	1 August 1958	-



EXHIBIT I  
TABLE 1 - Continued  
REPRESENTATIVES FORMING DELAWARE BASIN  
SURVEY COORDINATING COMMITTEE

AGENCY REPRESENTED	COMMITTEE MEMBER	DATES OF SERVICE	
		From	To
State of New York	Mr. Thorndike A. Saville	24 January 1957	16 February 1958
	Mr. Ronald B. Peterson	17 February 1958	-
City of New York	Mr. Irving V. A. Huie 2/	19 November 1956	30 August 1957
	Mr. Vincent G. Terenzio	31 August 1957	7 October 1957
	Mr. Arthur C. Ford	8 October 1957	-
City of Philadelphia	Mr. Samuel S. Baxter	2 April 1957	-

1/ Chairman of Committee  
2/ Deceased

\* MINUTES OF THE FIRST MEETING  
OF THE  
DELAWARE BASIN SURVEY COORDINATING COMMITTEE  
HELD 2-3 APRIL 1957  
AT ATLANTIC CITY, NEW JERSEY

1. INTRODUCTION

The Committee was convened in the Chevy Chase Room, Marlborough-Blenheim Hotel, Atlantic City, New Jersey, at 10:20 A.M., Tuesday, 2 April 1957 by the Chairman, Colonel Allen F. Clark, Jr. The following members, or alternates, represented their respective agencies:

Mr. Fred H. Larson, Dept. of Agriculture  
Mr. Richard Ackroyd for Mr. S. L. Taylor, Dept. of Commerce  
Mr. Sylvan C. Martin, Dept. of Health, Education and Welfare  
Mr. D. R. Gascoyne, Dept. of the Interior  
Mr. Frank E. Johnson for Mr. John F. Foy, Dept. of Labor  
Mr. John H. Spellman, Federal Power Commission  
Mr. A. Joel Kaplovsky, for Mr. Richard Haber, State of Delaware  
Mr. Joseph E. McLean, State of New Jersey  
Dr. Thorndike Saville, State of New York  
Mr. Maurice K. Goddard, Commonwealth of Pennsylvania  
Major Irving V. A. Huie, City of New York  
Mr. Samuel S. Baxter, City of Philadelphia

The Chairman welcomed the members of the Committee and their staffs, and since this was the Committee's initial meeting, the Chairman introduced each of the members and their alternates. He then introduced the members of his own staff that were present and representatives of other groups, who were not members of the Committee. A list of all these in attendance at the first day's meeting of the Committee is shown in Appendix A of these minutes. The agenda for the meeting was introduced by the Chairman and is shown in Appendix B.

\* See minutes of next meeting for corrections

## 2. COMMITTEE'S COMMISSION

The Chairman quoted the following excerpts from letters which led to the formation of this Committee, and which outlined its purpose and functions:

a. Letter of 11 September 1956, Assistant Secretary of the Army to the Under-Secretary of the Interior

"First let say that in carrying out its assignment the Corps of Engineers conceives of its position as being mainly that of a coordinator in the development of a plan which will encompass many functions and activities not within this Department's sphere of authority. In fact, it is probable that a major part of the plan will be carried out by non-Federal interests, or by Federal agencies other than the Corps".

b. Letter of 22 October 1956, President of the United States to the Secretary of the Army

"The Department of the Army and the Corps of Engineers should feel free to invite the representatives of the Federal agencies and non-Federal public instrumentalities to participate in coordinating committees or advisory groups. I believe that it would be desirable to supplement other procedures for inter-agency cooperation with regular meetings at which Federal, State and Municipal representatives can review progress and discuss problems of general interest".

c. Letter 12 January 1957, Assistant Secretary of the Army to Other Federal Departments.

"The main functions of the Coordinating Committee will be to make periodic examinations of progress being made in the various studies, to discuss problems, and to assist and advise all participating agencies". The Chairman stated that he felt that the Committee should address itself to the problem of the preparation of the best possible water resources survey of the Delaware River Basin that can be made, and that any activity of the Committee in the furtherance of that objective was a proper activity of the Committee.

## 3. QUAKER WAY OF CONDUCTING MEETINGS

The Chairman called attention to an article entitled: "The Quaker Way Wins New Adherents". This article appeared in New York Times Sunday Magazine on 17 June 1951, and was written by Morris Llewellyn Cooke, who at that time was Chairman of the President's Water Resources Policy Commission. The Chairman read the following excerpts from the above article:

a. "The faults of the conventional parliamentary procedure arise from its basic assumption that there exists a divergence of interests rather than a common purpose. The introduction of a yea-and-

may vote is conceived as a kind of contest between opposing forces, each going into battle armed with fully formed conclusions which it then attempts to put over on the other side. If a group cannot force acceptance of the whole program, then it proceeds by a process of barter, to swap point for point - often without regard to the right or wrong of the individual points".

b. "The Quaker practice of 'taking the sense of the meeting' on the other hand, is a combination of free discussion and quiet thinking. 'The Quaker form of Church government' says Howard H. Brinton, Director of Pendle Hill, Friend's Graduate School at Wallingford, Pa. 'is the most complete democracy ever devised. Not only do the Quakers refuse to admit the imposed authority of any individual, they do not even admit the authority of a majority. All decisions must be made on the basis of unanimity, reached by a process that considers the opinion of every person, both expert and inexperienced. Therefore, a Quaker committee sometimes appears to be amateurish and time-consuming".

c. "It is well worth this time, in the Quaker view, to develop in a group the willingness to accept unanimously what appears to be the balanced judgment of the majority or the best informed".

d. "First, according to this procedure, a subject is introduced not by presenting a resolution but by 'reading a query'. This is usually done by the Chairman - or 'Clerk of the Meeting', as he is known in Quaker groups. Such a departure from parliamentary order is by no means a petty one, for by this simple device, the issue seems to come from the group as a whole instead of being sponsored by one faction within it".

e. "Various points of view on the subject are expressed by individual members - whoever wishes to contribute. But strong words, provocative language and repetitive discourse are taboo; members are encouraged to speak just once on a given point, and only after careful thought".

f. "If conflict at any point becomes so heated as to make an agreement doubtful, the Clerk may halt discussion and ask the members to consider the subject for a while in thoughtful silence".

g. "There is never any voting. When a positive program of action appears to have been indicated by the evidence brought to bear on the subject, the Clerk sums it up by 'presenting a minute' expressing what he takes to be 'the sense of the meeting' - the consensus, the course of action which would take into account the most significant pieces of evidence contributed by all the members".

h. "The 'sense of the meeting' stands as the group's decision unless some challenge is made by an unsatisfied individual. In this case the Clerk may suspend the subject for the time being - true unanimity obviously being out of the question - to permit more careful consideration and perhaps to gather more facts. A committee may be



appointed for research and to prepare a report for the next meeting when a new attempt is made to attain unity".

i. "\* \* \* there are two principal elements in the practice. There must be a belief on the part of all or most of the participants in the meeting that agreement is desirable. Secondly, the belief must be entertained that in any decisions taken the way should be left open for the skeptics, eventually to join in the view reached by the main body of the group."

#### 4. ADOPTION OF METHOD

The Chairman commented on a number of the principles outlined in the above extracts and then proposed that all meetings of the Delaware Basin Survey Coordinating Committee that this Quaker Way would be followed. Under this method the Chairman would act as "Clerk of the Meeting". He would listen to the discussion of each particular point, and at the time when it seemed to him that the Committee has begun to reach an agreement, he would summarize each point and so state it as the "sense of the meeting". Then if there were no objections it would stand as the decision of the Committee. If it were challenged and there could be no unanimity, the Chairman would suspend the subject for the time being to permit more careful consideration and the gathering of more facts relating to the subject. The Chairman called for comments, or discussion of his proposal for conducting the Committee meetings. Very limited comments followed and all seemed to be in agreement with the proposal. The Chairman then announced that it was "the sense of the meeting that this 'Quaker Way' of conducting meetings had been adopted and would be used in all future meetings".

#### 5. PROCEDURAL PLAN OF SURVEY

Lt. Colonel John C. H. Lee, Jr. on the staff of the District Engineer, Army Engineer District, Philadelphia, distributed copies of the Data Book for the Delaware River Basin Survey to all participants in the meeting. He called special attention to Exhibit 2-9, "Procedural Plan for Survey of the Delaware River Basin Water Resources", explained several of the minor changes recently made in this document, and reviewed many details in the document. In the discussion period which followed Mr. Frank Weaver, Federal Power Commission, raised the question, in regard to the presentation of structures included in the comprehensive plan of development, as to whether or not structures to be constructed by private interests would be excluded from this plan. Colonel Lee explained that the report would in no way exclude government - private interest partnership agreements, and the proposed plan would not prevent private interests from developing projects, such as a power project at Tocks Island or Wallpack Bend. Mr. Goddard, representing the Governor of Pennsylvania, inquired as to the method preferred for advising the District Engineer of various flood control projects that may be undertaken by the various states. The Chairman explained that a letter to the District Engineer describing the project would be sufficient and that the Valley Report Group would reproduce the data and distribute copies to all interested agencies.

## 6. INTRODUCTION OF DATA BOOK

Mr. David E. Donley, Valley Report Group reviewed the Data Book that had been distributed earlier. He pointed out that this compilation had been made to provide common data for use by all the agencies concerned and that suggestions for inclusion of additional data, as well as corrections of any error, would be welcomed. He stated that it was proposed to issue revisions and additions to this book from time to time as they become necessary. He urged that all recipients of the book fill out and return the Receipt Form on Page 5-2 so that such future distribution of material could be properly made directly to the holder of the book.

## 7. STATUS OF CORPS OF ENGINEERS STUDIES

Mr. Russell Morgan, Chief, Valley Report Group, presented a status report on the work accomplished to date on this survey by the Valley Report Group. A short discussion followed this report. A representative of the State of New York requested information on the effect of Tocks Island Reservoir on flood heights at Port Jervis, N. Y. and the Chairman advised that a special report on this problem would be presented at the next Committee meeting. Mr. George Shanklin, from New Jersey, requested that data such as unit hydrographs, frequency curves, etc., be made available in preliminary form as soon as they were developed, so that the State agencies could utilize such data in their studies. The Chairman advised that such data could be so distributed and would be as time for its preparation and distribution permitted.

## 8. MAP REQUIREMENTS

Base maps developed for use in the survey were described by Colonel Lee. Dean Thorndike Saville inquired if it was planned to use photogrammetry on this survey and stated that he felt that aerial mapping was desirable particularly for specific projects.

## 9. STATUS REPORT - OFFICE OF BUSINESS ECONOMICS

A statement of the work being done by the Office of Business Economics in the Department of Commerce was presented by Mr. C. A. R. Wardwell and Mr. Robert E. Graham from that office. Mr. Wardwell pointed out OBE qualifications for making projections. He stated that data will be broken down in geographic units from the states to a sub-regional basis and will be grouped in eight sub-regions. These data will provide an economic basis for estimating water uses for the year 2010 and intervening years. Any projection to year 2010 will have available the comparable data for current times. OBE will furnish estimates of population, number of consuming units, and work activities of these units, also estimates of the standard of living for these consuming units on a per capita basis. The figures on entire national economy will be basic and those for the Delaware region will be secondary. If national projections are correct then those for the Delaware region will be reasonable. The present status of these estimates is as follows:

Population estimates from Bureau of Census have been received for years 1960-65, 70, 75, 80, 85, 90, 95, 2000, 2005, and 2010. Maximum estimate for 2010 is 440,000,000 and minimum estimate is 280,000,000. Difference in estimates results from assumptions on differences in fertility, particularly beyond year 1975. Present (1956) fertility rate is higher than that immediately after World War II and is higher than that projected in 1950. Population projections for counties will be available by the last of June. The Bureau of Census will also furnish projections of labor force, and OBE will take these values and project output per man for nation (productivity per man) and then make an estimate of Gross National Product in constant dollars. OBE is making an investigation of economic growth pattern for counties (50 years / of history) and will relate changes of these patterns to national patterns. Trends seem stable with very few radical changes and will be used in projecting for the sub-regions on an industry basis. These projections should be quite useful for those making studies for local areas. Industrial patterns should throw considerable light on water demands while household projections and industrial outputs will also be useful in estimating water uses. Mr. Graham reported on work underway on incomes and referred to the recent book, "Personal Incomes" which shows incomes by States. These data provide a reasonable basis for projecting regional economic growth. Mr. Graham stated that personal income presents the best economic index of production by sub-area and hopes to be able to provide a detailed breakdown (by sub-areas) of income from major sources. Rough approximations for Delaware service area show that it has 20% of total national income, or 75 billion dollars, and that per capita income in this area is 20% above U. S. average (\$2200). The following points were developed during the discussion period which followed this presentation:

- a. Preliminary projections by commodities will be available about 3 to 4 months after population projections are available.
- b. Differences in population projections will be resolved by relating them to economic factors.
- c. These projections will not project patterns but present development will be used.
- d. The effect of new highways on economic development is not being appraised since it is not practicable to assign values to them.
- e. Present population of service area is estimated at 20,000,000 persons. Population will be projected to 2010; water uses will be projected to 2060 with help of OBE.
- f. Projections can be reduced to counties or sub-portions of counties by same procedures but will be subject to considerable error. The commuting problem is involved, and it will be virtually impossible to determine its effects.

10. STATUS REPORT - OTHER STUDIES - DEPARTMENT OF COMMERCE

The status of other studies being carried on by the Department of Commerce was reported on by Mr. Ackroyd who advised that seven agencies in his department were listed as cooperating in report. He introduced Mr. Nordensen and Mr. Kresge of Weather Bureau who gave brief reports on special studies being made by that agency. These studies include the preparation of the following maps to show their results:

- a. Normal annual precipitation map
- b. Evaporation map
- c. Air temperature map
- d. Seasonal map of air-water evaporation
- e. Map of storm paths

They reported that lake evaporation rates will be studied as part of atlas of USGS. This study will be similar to that prepared for NENYAC. The maps published in this atlas will be on a scale 1:500,000. They requested that the Weather Bureau be furnished all unpublished but available records of pan evaporation. The New York Board of Water Supply has furnished those collected by that agency. Mr. Ackroyd reported further that OAD is making no studies at this time that relate to the Delaware Basin. Likewise the Office of the Undersecretary for Transportation does not have an independent study underway. USC&GS have reviewed control for the Delaware River Basin and estimate that 160 triangulation stations and 122 miles of leveling are needed to provide better controls in the basin. The estimated cost of such controls is approximately \$190,000 and about 1-1/2 to 2 years of advance notice will be required to get this work included in USC&GS program. The C&GS also reported that a number of BM's were lost during the 1955 flood. Bureau of Public Roads is making no special studies for this survey. However planning is being done for new roads from Port Jervis to Scranton and from Port Jervis to New York and from Harrisburg to Stroudsburg as well as new crossings at Trenton, Philadelphia (2), Delaware Bay (1). The question period on this report brought out the following points:

a. Lack of time and money will not permit the establishment of the additional controls suggested by the USC&GS, as a part of this survey.

b. Unless the states initiate it, the Bureau of Public Roads is not permitted to encourage advance road planning by some sort of incentive payments. If the states initiate it, U. S. Public Roads can loan them money at 1.5 percent interest.



11. STATUS REPORT - DEPARTMENT OF LABOR

Mr. Johnson reported for the Department of Labor, that that department had not been requested to carry out any studies relating to the Delaware River Basin.

12. STATUS REPORT - FEDERAL POWER COMMISSION

A report on the activities of the Federal Power Commission was presented by Mr. Spellman. He stated that his commission expects to develop a complete power market survey for the Delaware River Basin. This will indicate requirements thru 1980. Twenty to twenty-five years into future is as far as FPC would like to estimate such requirements. The area will be able to absorb all the power to be expected to be developed from Delaware in next 25 years. The FPC will determine power values for use in economic analyses of multiple purpose projects and will examine value of single purpose power projects also. Mr. Spellman explained that the preliminary permit requested by the Delaware River Development Corporation for Tocks Island, if issued would merely give them priority in issuance of license and would be good for 3 years. The Chairman was requested to investigate status of Corps of Engineers' activities with regard to proposed preliminary permit on Wallpack Bend and to report on these at next meeting of the Coordinating Committee.

13. STATUS REPORT - U. S. PUBLIC HEALTH SERVICE

Mr. Martin from Public Health Service, Department of Health, Education and Welfare, reviewed studies that USPHS has agreed to make and stated that outlines for report by that agency would soon be available. Mr. Martin, by request, commented on the study his agency was making on the determination of rates of water use, and values thereof - present and future. He was also asked to comment as to whether the survey was making the proper approach to the determination of water rate use and values. He affirmed that the proper approach was being made and that they were going to project past trends in water use and would try to adjust them for deviations in the future to the extent that they can intelligently be estimated. Mr. Martin stated that his agency would be glad to cooperate with Major Huie and Mr. Baxter in developing estimates of future requirements. It was agreed that group considerations and decisions should be relied upon for final answer.

14. STATUS REPORT - DEPARTMENT OF THE INTERIOR

The Chairman introduced Mr. D. R. Gascoyne, who represented the Department of the Interior, to report on the status of the studies being carried on by that agency for the Delaware Survey.

a. U. S. Geological Survey. Mr. Gascoyne introduced Mr. Barksdale to report on those studies under way in the U. S. Geological Survey. Mr. Barksdale stated that the Water Resources Division will complete the

compilation and review of surface water data in some states before completion of Delaware River Survey. He stated that his agency had collected a considerable amount of data on groundwater in the Delaware Basin and can give general answers on quantity of groundwater in a lot of places but is still unable to give detailed and specific answers. A groundwater report is under preparation to show all available data and will probably be ready by FY-58. A preliminary draft report will be ready by June 1957. The atlas for the Delaware Basin and the report to accompany it, that is under preparation by Mr. Gerald Parker in Upper Darby, Pa., will be completed by the time the Delaware River Report is scheduled for submission.

b. U. S. Bureau of Mines, Mr. Gascoyne introduced Mr. Norwood B. Melcher from U. S. Bureau of Mines, who gave a short review of their potential service to the Delaware River investigation. He stated that a report on the water requirements for development of the mineral resources of the Basin would require two full calendar years to complete after such a report was authorized. Due to present fund limitations this study has not been undertaken.

c. National Park Service, Mr. Gascoyne next introduced Mr. George Thompson, of the National Park Service, who gave a short review of his work. He said emphasis would be placed on the need for recreational water use, and that the Park Service survey was concerned with non-urban outdoor recreation, and information on both public and private recreation facilities is now being collected.

d. U. S. Fish and Wildlife Service, Mr. Russell T. Norris of U. S. Fish and Wildlife Service, introduced by Mr. Gascoyne, explained that his agency was now reorganized into a Bureau of Sport Fisheries and Wildlife, and a Bureau of Commercial Fisheries. He stated that Fish and Wildlife Service expected to completely staff an office in Trenton, N. J. within next few weeks for work on Delaware River problems and that major emphasis would be put on fish and wildlife developments in this basin. He also explained that they will examine other proposed water resources studies to evaluate the effect of their proposals on fish and wildlife. Mr. Norris reported that organization meetings have been held with state technical personnel of game and fish agencies and collection of data necessary for the report is in progress. In the discussion which followed the report by the Department of the Interior, Mr. Martin of PHS raised a question as to what areas were to be included in various phases of the collection of water use data and suggested that these be defined by individual studies. Colonel Lee explained the general area delineation, with reference to water uses and projects studied. He stated that the investigation will take a look at the water available in the river service area and that this water availability, when compared with water demands, will indicate the eventual need for diversion of water out of and into the Delaware River basin. Mr. Martin requested that his agency be provided a further delineation of the areas to be used in various phases of their studies since they seem to go beyond original agreements. The Chairman requested Mr. Gascoyne to give a special report at the next Coordinating Committee meeting concerning water use requirements for recreation.

15. STATUS REPORT - DEPARTMENT OF AGRICULTURE

A report was presented by Mr. Fred Larson from the Soil Conservation Service, on the studies underway in the Department of Agriculture. He mentioned the differentiation between flood damages and sediment damages, and explained the use of small headwater dams for water retardation and how they may be incorporated into river basin planning studies. He stated that a book of reference to all reports of the Department of Agriculture is available in SCS. The potential use of desalted sea water for irrigation was mentioned and the Chairman requested Mr. Gascoyne to report on developments in desalting sea water at next meeting of the Coordinating Committee.

16. STATEMENT - REPRESENTATIVE FROM DELAWARE

Mr. Kaplovsky, representing the State of Delaware, reported on human population conditions and industrial expansion of Delaware and the effects upon these expected to be achieved by the Delaware Survey report.

17. STATEMENT - REPRESENTATIVE FROM NEW JERSEY

Mr. McLean, representing the State of New Jersey, gave a short report and advised that Governor Meyner, of New Jersey, has cooperated with the Governor of Delaware and that he feels that coordination at the general administrative level of government is essential to the success of inter-agency planning.

18. STATEMENT - REPRESENTATIVE OF NEW YORK

Mr. Peterson, representing the State of New York, reported that the state had a vital interest in the Delaware River problem and all thinking in his state was carefully measured and appraised. He said at the time the Supreme Court declared New York's interest in the Delaware water, New York felt that under the conditions of that decree no further allocation of water would be necessary.

19. STATEMENT - REPRESENTATIVE OF PENNSYLVANIA

Mr. Goddard, representing the State of Pennsylvania, listed flood control works completed and underway in Delaware Basin by the State of Pennsylvania. He suggested that the Delaware River Master be invited to the next meeting of the Coordinating Committee.

20. STATEMENT - REPRESENTATIVE OF NEW YORK CITY

Major Huie, representing the City of New York, reported that the city was vitally interested in the Delaware River Basin Survey and was glad to cooperate in it.

21. STATEMENT - REPRESENTATIVE OF PHILADELPHIA

Mr. Baxter, representing the City of Philadelphia, reported that this city was interested in the survey and felt that metropolitan areas

should plan for 100 years, but should hedge in fixing hard and fast demands for future water supplies due to difficulties in projecting future growth patterns for cities.

## 22. STATEMENT - DELAWARE RIVER BASIN ADVISORY COMMITTEE

The Chairman introduced Mr. Walter M. Phillips, Executive Secretary of the Delaware River Basin Advisory Committee. He reported briefly on the proposed funding arrangements and other details pertaining to the proposed study on governmental structure about to be undertaken by Dr. Martin of Syracuse University for the Delaware River Basin Research Corporation. With regard to continuing activities of the Advisory Committee he requested that all agencies keep this committee advised of what they are doing.

## 23. DISCUSSION OF GROUND WATER DATA REQUIREMENTS

The Chairman introduced a discussion on ground water data requirements. A representative from New Jersey stated that his state was interested in getting surface water planning coordinated with ground water availability. This has not been practicable because of lack of basic facts for engineering planning development. The Chairman pointed out that a report of this type should present facts rather than judgment estimates.

## 24. DISCUSSION ON HEADWATER DAMS

Mr. Larson from Soil Conservation Service, presented a report on small headwater dams. He stated that the general view of SCS is to set up a structure program but that some confusion exists about this problem. Smaller headwater dams are evaluated the same as the Corps of Engineers evaluates larger ones. Colonel Lee mentioned that despite lack of higher level approval on a Memorandum of Understanding, a joint work plan for the investigation of small dams has been worked up thru exchange of letters between the Department of Agriculture and the U. S. Army Engineer District and is now in operation.

## 25. FUTURE COMMITTEE MEETING

The Chairman announced that it was the "sense of the meeting" that technical meetings should be held from time to time at which detailed discussion would be conducted on special subjects. Those members of the Coordinating Committee who were interested in such specific subjects would attend these technical meetings. Meetings of the entire Coordination Committee would be held from time to time as developments in the comprehensive survey dictate. Such meetings would generally be open meetings. The Chairman would announce the date for the next meeting.



26. PROPOSED FUND ALLOCATIONS

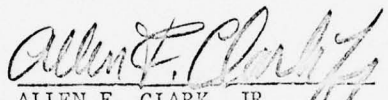
The Chairman called a closed meeting of the Members of the Coordinating Committee, after recess of the regular session on 2 April 1957, to discuss proposed allocation of Federal funds to Federal agencies for Fiscal Year 1958. The probable allocations under several assumed appropriations were reviewed.

27. ADJOURNMENT

The Chairman adjourned the first meeting of the Coordinating Committee at 1:15 P.M. on 3 April 1957

Inclosures

- Appendix A -
- Attendance List
- Appendix B -
- Agenda

  
ALLEN F. CLARK, JR.  
Colonel, Corps of Engineers  
Chairman

\*MINUTES OF THE SECOND MEETING  
OF THE  
DELAWARE BASIN SURVEY COORDINATING COMMITTEE  
HELD 15-16 AUGUST 1957  
AT BETHLEHEM, PENNA.

1. ADDRESS OF WELCOME

The Committee was convened in McClintic-Marshall Hall at Lehigh University, Bethlehem, Pa. at 9:30 A.M., E.D.S.T., on 15 August 1957, by Col. Allen F. Clark, Jr., Chairman. He introduced Dr. Martin D. Whitaker, President of Lehigh University, who welcomed the conference and emphasized the importance of the work being undertaken. In accordance with the agreement reached at the Atlantic City meeting, Col. Clark stated that the meeting would again proceed by the Quaker method whereby the Chairman evaluates the "sense of the meeting".

2. INTRODUCTION OF MEMBERS

Mr. Fred H. Larson, Dept. of Agriculture  
Mr. Richard Ackroyd for Mr. S. L. Taylor, Dept. of Commerce  
Mr. Sylvan C. Martin, Dept. of Health, Education and Welfare  
Mr. L. N. Stevens for Mr. D. R. Gascoyne, Dept. of the Interior  
Mr. H. R. Brown for Mr. John F. Foy, Dept. of Labor  
Mr. John H. Spellman, Federal Power Commission  
Mr. A. Joel Kaplovsky for Mr. Richard A. Haber, State of Delaware  
Mr. B. Budd Chavooshian for Mr. J. E. McLean, State of New Jersey  
Mr. Edwin L. Vopelak, observer for the State of New York  
Mr. Maurice K. Goddard, Commonwealth of Pennsylvania  
Mr. V. G. Terenzio for Major I. V. A. Huie, City of New York  
Mr. G. E. Arnold for Mr. S. S. Baxter, City of Philadelphia

\* See minutes of next meeting for corrections.

These Committeemen, in turn, introduced the several representatives of their departments and agencies. A list of those present, appropriately grouped, is attached hereto as Appendix A.

Mr. V. G. Terenzio of the New York City Board of Water Supply reported on the extended illness of Major Irving V. A. Huie, President of the Board and the City of New York member of the Committee.

Col. Clark introduced Lt. Col. Frank A. Gerig, Jr., who has replaced Col. John C. H. Lee, Jr., as Assistant for Valley Reports, and the civilian members of this staff who were present.

### 3. COMMENTS ON MINUTES OF PREVIOUS MEETING

The Chairman asked for comments on the minutes of the Atlantic City meeting of 2 and 3 April 1957. The following changes were requested:

By Robert E. Graham - Office of Business Economics:

Page 6, Item 9: delete next to the last sentence commencing "Rough approximations for Delaware service ..... above U. S. average (\$2,200)" and substitute therefor, "Rough approximations for the Delaware service area show that it has 16% of the total national personal income, or 50-55 billion dollars and that the per capita income in this area is 20% above the U. S. average (\$2,400)."

By T. J. Nordenson - U. S. Weather Bureau:

Page 7, Item 9, subpara. "d": delete in its entirety and substitute therefor, "d. Seasonal maps of evaporation and precipitation."

By Richard Ackroyd, Bureau of Public Roads, Dept. of Commerce:

Page 7, Item 10, Line 23: delete sentence commencing "The estimated cost of such controls ..... loan them money at 1.5 percent interest" and substitute therefor, "The estimated cost of such controls is approximately \$190,000, if the work is to be done immediately on a reimbursable cost basis. If 1-1/2 to 2 years of advance notice could be given, it might be possible to get this work included in the regular USC&GS program using regular appropriated funds. The C&GS also reported that a number of bench marks were lost during the August 1955 flood. The Bureau of Public Roads is making no special studies for this survey. However, planning is being done for new interstate highways from Scranton, Pennsylvania to Newburgh, New York, via Port Jervis, New York; Scranton, Pennsylvania to New York City via Stroudsburg, Pennsylvania; and Harrisburg, Pennsylvania to New York City via Easton, Pennsylvania. The question period on this report brought out the following points:

"a. Lack of time and money will not permit the establishment of the additional controls suggested by the USC&GS, as a part of this survey.

"b. One and one-half percent of all Federal-aid highway allotments to the states is earmarked for planning and research. Projects using these funds are initiated by the state highway departments and are subject to the approval of the Bureau of Public Roads. Such projects include traffic studies, mapping, route sufficiency studies, and economic investigations leading to the determination of the proper location of highways. Except for the interstate programs, states seldom plan their highway locations more than one to four years ahead."

By Fred H. Larson - Soil Conservation Service, Department of Agriculture:

Page 11, Item 24, 2d sentence: delete sentence in its entirety.

The minutes were approved, subject to the above mentioned changes. The agenda for the meeting, as conducted, is attached as Appendix B.

#### 4. DELAWARE RIVER DEVELOPMENT CORPORATION'S APPLICATION

Mr. John H. Spellman of the Federal Power Commission reviewed the present status of the application of the Delaware River Development Corporation for a preliminary permit for proposed project No. 2196, on the main stem of the Delaware River in the vicinity of Tocks Island as discussed at the meeting at Atlantic City on 2 April. He stated that many letters had been received in opposition to the granting of this permit. On 17 July, the Corporation asked for permission to withdraw its application citing as reasons the New Jersey law which requires work to begin within two years after the applicant's incorporation, which was impossible, and the comprehensive Federal survey presently underway. On 2 August, the Commission staff, after reviewing all of this material, recommended to the Commission that the application for permission to withdraw be granted without prejudice. At the moment it is under consideration but no action has been taken. Mr. Spellman agreed to keep the Committee advised of any new application by the Corporation. In answer to a question by Mr. Goddard of Pennsylvania, Mr. Spellman stated a decision might be made by the Commission in another month or two; that there was no objection to the petition for withdrawal which he could see. He also stated that the withdrawal of the application without prejudice means that the application may be renewed.

#### 5. POOL LEVELS ABOVE TOCKS ISLAND

Mr. Russell Morgan, of the Philadelphia District of the Corps of Engineers, then reviewed the effects of several pool levels behind a dam at Tocks Island. A copy of this report is attached hereto marked Appendix C.



## 6. WATER USE FOR RECREATION

Mr. L. N. Stevens, representing the Department of the Interior on the Committee, introduced Mr. George H. Thompson of the National Park Service who presented a report on the use of water for recreation, a copy of which is attached hereto and marked Appendix D.

Mr. Shanklin of New Jersey inquired regarding data on recreational use at municipal water supply reservoirs, and suggested that these data should be included. Mr. Thompson stated that all these uses will be considered in the National Park Service's final report. He pointed out recent relaxation of regulations at Quabbin Reservoir in Massachusetts whereby the recreational use was increased. Mr. Shanklin said he was also concerned about reservoirs used for stream regulation. Mr. Thompson said this would be considered.

Mr. Terenzio stated that with respect to recreation at water supply reservoirs operated by the City of New York, there have been two stages in the regulatory program by the city authorities. During World War II, it became necessary to prohibit all recreational activities at the reservoirs. After the emergency passed, the reservoirs were opened for fishing and boating, but the right was limited to areas at a certain distance from the control works. New York City reservoirs release substantial amounts of water downstream and the authorities are mindful of recreational needs and benefits; however, they find that the drawdown at reservoirs is detrimental to recreational use. Mr. Terenzio feels that the maximum uses are now being made of the City's reservoirs.

Mr. Martin asked about the use of natural lakes as contrasted with artificial reservoirs. Mr. Spellman pointed out that the Federal Power Commission takes into consideration, in granting licenses, the fact that restrictions must be imposed on recreation because of reservoir drawdown.

Mr. Shanklin stated that water which will not be filtered before consumption is not practicable for recreational use. Mr. F. J. Trembley of the Lehigh Water Resources Research Council asked whether recreational facilities at the Tocks Island Reservoir would be evaluated. The answer was in the affirmative.

## 7. RESERVOIR LAND USE POLICY

Mr. L. G. Duck of the Philadelphia District of the Corps of Engineers presented a statement on land acquisition law and policy, and public use of Corps of Engineers' reservoirs. A copy is attached hereto as Appendix E.

Mr. Norris asked that the last sentence be re-read, and then requested affirmation of the policy expressed therein. Mr. Duck asserted that this sentence expresses the policy of the Corps of Engineers. Mr. Martin asked for clarification of the Bureau of Budget Circular No. A-47 which Mr. Duck attempted to supply. Mr. B. D. Murphy, Chief Engineer of the Pennsylvania Department of Forests & Waters, asked whether the Corps of Engineers had any criteria regarding acquisition of lands below dams. Col. Clark stated that the Corps was permitted to acquire land in fee only for project construction and borrow areas.

Mr. Larson suggested that a statement of policy be presented regarding recreational use of dams built under Public Law No. 566 and by municipalities.

Col. Clark stated that Mr. Duck's report would be reproduced and that other reports would be presented as appendixes or in summary. Mr. Shanklin suggested that the Bureau of the Budget Circular No. A-47 be incorporated as part of the Data Book. It was also requested that a summary or interpretation of the circular be issued. Col. Clark agreed that the matter would be taken under advisement for presentation at the next meeting. It was also suggested that a summary of recent laws and bills before legislative bodies on the subject of land acquisition policy be prepared. Mr. Stevens stated that there are two bills in Congress affecting this policy. Col. Clark said that they should be included in the presentation.

#### 8. DESALTING SEA WATER

Mr. Stevens introduced Mr. Don H. Huff, Executive Officer, Department of the Interior, who reported on behalf of that Department regarding its investigations of the feasibility of demineralizing saline water. The report is incorporated in these minutes as Appendix F.

Mr. Stevens pointed out that these studies were made under an act of Congress but that staff and funds were limited. Mr. Shanklin referred to a similar investigation on which a report is to be presented in the August issue of the American Water Works Association Journal.

#### 9. PROPOSED FUND ALLOCATIONS

The Chairman called a closed meeting of the Members of the Coordinating Committee at the end of the regular session on the morning of 15 August to discuss proposed allocation of Federal funds to Federal agencies for fiscal year 1968. The probable allocations under the expected appropriation were reviewed.

#### 10. STATUS REPORT - CORPS OF ENGINEERS

Mr. Morgan described the organization of the Valley Report Group and outlined the work and duties of each unit.

Mr. Martin asked whether the Corps is making frequency studies of low flows and the effect thereof. Mr. Morgan answered that such studies had been made for certain stations. He then indicated that the Group had little success in gathering information on existing dams in the watershed, particularly small ones. Mr. Murphy stated that his Department has information on small dams in Pennsylvania dating from 1913. Mr. Shanklin said that he has similar information for New Jersey dating from 1912. Mr. Martin asked whether an adequate map would be provided showing streams and flow frequencies. Mr. Morgan answered that such a map was being prepared over which particular data could be laid. This map would show the work of the Joint Work Group of the Soil Conservation Service and the Corps of Engineers.

Mr. Ackroyd asked whether the results of the study of unit hydrographs would be available prior to the completion of the report. Col. Clark answered in the affirmative. Mr. Morgan added that data on frequencies and unit hydrographs have been tabulated and those who have genuine use for it would be furnished copies of this tabulation upon request.

Col. Clark discussed the dissemination of reports on technical studies and proposed that they be made available on a "need-to-know" basis. It was the sense of the meeting that this was the only practicable procedure to be followed.

#### 11. STATUS REPORT - DEPARTMENT OF AGRICULTURE STUDIES

Mr. Larson made a report on the status of the work being done by the Department of Agriculture. He said that, with respect to Public Law No. 566, his Department is not interested merely in reservoirs for the protection of damage centers but also in reservoirs for water supply. He stated that the Soil Conservation Service is trying to locate all the reservoir sites in the basin, working closely with the Corps of Engineers. The work of the Soil Conservation Service is keeping up with the schedule set forth in the Data Book, Exhibit 2-46.

Mr. Larson said that the Department of Agriculture had made a study and inventory of the land and cover resources in the basin and is making a study of conservation needs. The Department of Agriculture has also started work on projections of changes in land use. Existing farm operations, management, rural use of water, etc. are all being studied and the trends evaluated. He stated that from the U. S. Geological Survey quadrangles, 325 dam sites have been located; that their

data had been compared with corresponding field data to determine the practicability of particular sites. He said that in addition to the 325 sites located by his Department, other agencies had suggested 40 others. He hoped that all would be examined by 15 September 1957. Mr. Larson observed that the Corps of Engineers made a map showing 40 sub-watersheds. These will be studied and covered by a report which will describe the particular problem on each sub-watershed; e.g. water supply, pollution or flood control. He said personnel of his staff plan to spend the week of 30 September with personnel of the Corps of Engineers working out hydrology problems and coordinating hydrologic techniques. Mr. Larson stated the Forest Service has determined the hydrologic condition of the forest lands, making on-site measurements and comparisons of forest areas.

During the question period following his status report, Mr. Larson discussed the capacity of reservoirs and locations of the dam sites under consideration, the number to be evaluated and the methods to be used. He said they were principally flood control structures. Col. Clark suggested additional work groups. Mr. Larson appeared to agree, and said that the eventual decisions respecting different sites might vary considerably according to the needs. Mr. Ackroyd suggested there might be interference with highway locations and advised those concerned to consult state highway departments about dam locations. Mr. Martin asked whether the Department of Agriculture works with pollution control people or INCODEL on evaluating effects of upstream reservoirs on low flows. Mr. Larson answered that nothing had been done on this as yet but that it was not being overlooked. Col. Clark suggested a report on hydrology for, and a statement on the procedure for investigating, the upstream auxiliary reservoirs be presented at the next meeting. Mr. Larson agreed and stated that the outline for the procedure has been developed, but that the outline for the report on the investigations by the Joint Work Group needs to be amended by the inclusion of a summary on the investigations in the sub-watersheds.

## 12. STATUS REPORT - DEPARTMENT OF COMMERCE - WEATHER BUREAU

Mr. Ackroyd introduced Mr. T. J. Nordenson of the U. S. Weather Bureau who gave a resume of the status of the Bureau's work with respect to the Delaware survey. He discussed average annual isohyetal maps and stated that tabulation of basic data has been completed and average annual precipitation for the years 1921 to 1950 computed for 300 stations. He said progress is being made in correlating average annual precipitation with selected topographic and meteorological parameters for the Upper Delaware River basin. It is anticipated that a preliminary free water evaporation map for the basin will be available in about a month.



### 13. STATUS REPORT - DEPARTMENT OF COMMERCE - OFFICE OF AREA DEVELOPMENT

Mr. Ackroyd introduced Mr. J. Slayten Jenner of the Office of Area Development of the Department of Commerce. He defined potential target areas for nuclear attack as follows:

- a. Concentrations of population in given area - 200,000 or more, by day or by night, within a four-mile diameter circle.
- b. Concentrations of industry - 16,000 or more workers within a four-mile diameter circle.
- c. Key military and industrial installations.

Mr. Jenner stated that potential target areas a and b can be determined from present population and manufacturing statistics, but that due to frequent situation changes it is difficult to give exact figures; therefor, the best they can do, if situations do not change, is to project to June 1958 to determine these target areas and potential damage sites and to use them.

Mr. Jenner stated that the Coast and Geodetic Survey will not be an expense to the Delaware survey if they can do the check on triangulation controls over a period of 1-1/2 to 2 years. If, on the other hand, a crash program must be undertaken, it will cost in the neighborhood of \$190,000. In answer to a question by Mr. Martin, Mr. Jenner stated that road plans for the most part are available only from state highway departments. However, the Department of Commerce has plans and locations for certain interstate highways and can furnish such data where it is not classified.

### 14. STATUS REPORT - FEDERAL POWER COMMISSION STUDIES

Mr. Spellman reported that his organization is making progress in its studies but that necessary refinements are dependent upon a compilation of population and industrial projections by the Office of Business Economics. He introduced Mr. L. B. Wolf who stated that the New York Office of the Federal Power Commission is preparing estimates of future power requirements in the area. He said that estimates of future electric loads are limited generally to periods extending not beyond 1980. Evaluations for more distant times are difficult and also unnecessary for most utility planning, but in view of the present survey needs, he said his office agrees to extend the estimates to the year 2010 with the understanding that all realize the limitations of such projections.

Mr. Woll said that in the Delaware basin survey area, the power requirements in 1955 amounted to approximately 47 billion kwh with a peak demand of 9.8 million kw. He stated the utilities of the area had, at the end of 1955, a total installed capacity of 10.6 million kw with nearly 96.5 percent of it in steam-electric plants. Estimates of future requirements indicate a 7.5 fold increase by 2010. He cautioned that these estimates are preliminary and subject to revision by the results of the economic base study being prepared for this survey by the Department of Commerce.

Dr. Kaplovsky asked whether this increase is due to increase in population or industry and the answer was "neither", since it is considered as a power projection only. Col. Clark stated that when the Office of Business Economics and the Federal Power Commission's projections are completed, their findings will be available.

#### 15. STATUS REPORT - PUBLIC HEALTH SERVICE STUDIES

Mr. Martin stated that his organization has completed the preliminary report on studies conducted to date. This report will be issued to the Work Groups on Water Supply and Water Pollution Control. Their studies have included:

- a. Determination of municipal water use in the Delaware River basin and the Delaware River service area.
- b. Determination of present industrial water use in the Delaware River basin only.
- c. Review and analysis of the existing data on the water quality of surface waters in the Delaware River basin.
- d. Development of a bibliography of source materials relating to the preceding items available at the Public Health Service Regional Office.
- e. Study and evaluation of the insects of public health importance in the Delaware River basin.

Mr. Martin stated that the municipal use includes all water supplied by the community water systems. Inventories have been made of communities of 10,000 population or over and samplings of those between 5,000 and 10,000 population. Special reports exist on the water supply of the cities of Philadelphia and New York since these two municipalities represent 75% of the Delaware River basin municipal water use. He was of the opinion that substantially complete data are now available.

Mr. Martin stated that analysis indicates a danger inherent in using average per capita usage figures for projecting water needs for large or dissimilar areas. In regard to field survey work, Mr. Martin stated that considerable data on water quality for the area below Trenton are available, but in respect to industrial use, the base data were analyzed for: (1) geographical distribution of industrial water use by both county and state; (2) distribution of water use by type of industry; (3) variations within given industrial types; and (4) proportion of use for various industrial purposes. He said a comparison was made of total industrial uses with municipal use on basin-wide and state-wide basis.

Mr. Martin further stated that in the water quality studies to date, consideration of the natural characteristics of the river has been confined to a study of the flow regimen. The effects of any modification of the existing stream flows by future projects will be evaluated on the basis of the results of the analyses made in this study.

Mr. Martin said a separate report on insects of probable health importance has been prepared. The malaria mosquito (*Anopheles quadrimaculatus*), deer fly and biting gnat were considered. He said the lower Delaware basin is noted for its mosquito problem. In a subsequent discussion it was brought out that on the whole the insect problem in the basin is not serious.

In regard to field survey work, Mr. Martin said considerable data on water quality are available for the Delaware below Trenton but that few data exist for the portion between Port Jervis and Trenton. This is the locality of Tocks Island and Wallpack Bend. Above Port Jervis, the New York City Board of Water Supply has furnished data which appear to be sufficient for studies of this portion of the river.

The speaker stated a field survey is in progress for the region between Port Jervis and Trenton. Twenty-two sampling stations have been established, four of which are on tributaries. Four types of surveys are being conducted which were described in some detail by Mr. Martin but which, for reasons of space, are not reproduced in these minutes. Mr. Martin described these types and named the directing personnel. He thanked the City of Easton, Bethlehem Steel Company, the States of Pennsylvania and New Jersey, and other Federal authorities for their cooperation with the Public Health Service. He stated that the work in FY-58 will be less comprehensive than in the past year because of the cutback in funds.

He said revised water use reports will be submitted to the Corps of Engineers and with the projections of municipal and industrial growth, the evaluation of future water use will be possible. After that, he said, it will be practicable to evaluate: (1) maximum pollution loads allowable; (2) effects of proposed developments on water quality; and (3) the required degree and types of water treatment.

He paid tribute to the inspiring leadership of Col. John C. H. Lee, Jr. and wished to acknowledge publicly his contribution in getting the work started on the Delaware basin survey.

#### 16. STATUS REPORT - U. S. GEOLOGICAL SURVEY STUDIES

Mr. Stevens introduced Mr. George E. Ferguson of the U.S. Geological Survey who described three kinds of activity in his organization.

a. Coordination of water resources investigations and locating hydrologic information required therefor.

b. The work requested by the Corps of Engineers over a year ago, for a \$75,000 definitive survey of certain basic hydrologic information in respect to what has been happening.

c. The current work of the U. S. Geological Survey defining for the first time the present basin-wide general hydrology.

Mr. Ferguson discussed the ground water potential in the rural areas in Pennsylvania and New York and to a certain extent in other states. He indicated that there is duplication in certain Data Book outlines. He believes that there is a need to find out where we are program-wise and where more work is needed, and that efforts should be concentrated in the next several years to bring out the true picture of the hydrology of the basin.

#### 17. STATUS REPORT - NATIONAL PARK SERVICE STUDIES

Mr. Stevens introduced Mr. George H. Thompson who made a report on the progress on recreational studies of the National Park Service. The studies include recreational resources of the Delaware basin, the New Jersey seacoast and Delaware Bay. Mr. Thompson stated that meetings were held with each State Coordinator and the procedure for the studies agreed upon. The accomplishments to date are as follows:

a. An inventory of existing public non-urban recreational areas. The tabulation of this information is 95% complete.

b. Field studies of existing public recreation areas have been completed.

c. Field studies of existing private and commercial areas have been initiated.

d. An inventory of existing water areas has been started with a view to locating any that appear available for public recreation.



e. The inventory of potential recreation areas which have been proposed for preservation and park development has been begun.

f. Preliminary field reconnaissance surveys of the physical characteristics of the basin have been completed.

g. A draft of general background material pertaining to the basin is almost completed.

h. Questionnaires have been designed and procedures established for the conduct of a survey to determine the recreational desires of the people of the basin.

i. Conferences have been held with the city historians in New York and Pennsylvania; with the historical societies in each basin state and other state offices and individuals.

j. An inventory of historical sites within the basin is approximately 50% complete and inspection of historical areas is being conducted.

k. Brief statement of historical background for each basin state has been prepared.

l. State archeologists were consulted and a review of the available information covering archeological sites within the proposed Tocks Island water control project was made.

#### 18. STATUS REPORT - FISH & WILDLIFE SERVICE STUDIES

Mr. Stevens introduced Mr. Russell T. Norris who described the studies of the Fish & Wildlife Service in the several states and praised the assistance given by the state organizations. He divided the Delaware basin into three areas. The most northerly, the Pocono-Catskill Highlands which he characterized as (a) sparsely settled; (b) mostly wooded; (c) abounding in bodies of water and fishing areas; and (d) being near cities.

Mr. Norris said that the Highlands area has become extremely popular as a recreational retreat because of its excellent fishing facilities. He described the variety of game fish abounding in the natural waters and the tremendous amount of "fishing pressure" imposed upon the waters of this vacationland. Because of this pressure, the New York, New Jersey, Pennsylvania and Federal fish and wildlife agencies have stocked the area each year with tons of fish - mostly trout of legal size.

Mr. Norris described the resort facilities of the area and the private ponds used chiefly for boating and fishing. Although too small to be included on maps and tables, these small bodies of water are very important to the resort business Mr. Norris stated. He asserted that the major industry of this whole area for the foreseeable future will continue to be recreation. Therefore, he stated, the economic importance of the area's fishery resource, both locally and to the states, can hardly be overemphasized.

Mr. Norris next described the Piedmont Plateau which occupies that part of the basin below the Blue and Kittatinny Mountains and the Musconetcong River, and above the fall line through Trenton and northern Delaware. Here, he said, the forests are smaller, the population greater, and the lakes, ponds and reservoirs fewer. The streams are less turbulent, due to less rugged terrain, but are much more polluted. Mr. Norris stated that over 280 streams have been classified. Trout fishing is of considerable importance and is artificially assisted by hatchery fish. Other species are much sought in this section.

Mr. Norris described the Lehigh and Schuylkill Rivers as the principal tributaries in this region. He stated that the Schuylkill, through a costly cleanup is now recovering in areas formerly considered aquatic deserts. He cited this as an example of how additional land and waters may be restored for recreational use by a cleanup of polluted waters.

He discussed the Coastal Plain and mentioned its complicated fishery situation. He noted that below Trenton, pickerel fishing is very popular; and below Camden on the New Jersey side, much carp fishing is done. He said that in the lakes and ponds large mouth bass are popular.

Mr. Norris named many varieties of fish taken from the Coastal Plain section of the basin. He also discussed sport and commercial fishing in Delaware Bay and the lower regions of the river, naming the varieties of both finfish and shellfish.

Lastly he discussed water pollution, noting that many fish are killed and that spawning of important species is drastically curtailed by the pollution of the Delaware and its tributaries. He felt that elimination of pollution would lead to a decided increase in the fishery resources of the basin without the addition of any new water. He stated that work on water fowl and aquatic fur animal resources inventories is progressing in all four states of the basin.

In answer to questions, Mr. Norris said he has no figure on the worth, as a fishery, of a mile of stream in the Coastal Plain; that streams are classed with reference to their usefulness to fishermen and

their suitability as fisheries; that the states decide what water is polluted. After discussion, Col. Clark suggested that a sub-committee work on pollution definition and control problems, with the possibility of a report at the next Coordinating Committee meeting.

Mr. Norris stated he has a tabulation showing loss of streams from public to private fishing; that the Chesapeake Bay Institute is making a study of shellfish in the Delaware basin and that the states are studying oyster problems. He said his surveys will make an impartial evaluation of all the information available.

#### 19. REPORTS BY THE STATES

Mr. Chavooshian had nothing to report on behalf of New Jersey.

For Pennsylvania, Secretary Goddard spoke of new dams and substantial new construction in recreational fields. He presented an illustrated brochure showing new Pennsylvania State Parks. He stated that his department is making property surveys and is about to run contour lines at elevations 420 and 430 above the Wallpack Bend dam site. He also observed that Pennsylvania had passed an act to permit the State to participate with New Jersey and the Federal government in building a dam at a location other than Wallpack Bend which had been the only site specified in the previous legislation.

Dr. J. A. Kaplovsky, on behalf of the State of Delaware, announced that the Delaware Coordinating Committee had been organized and an "assignment outline" prepared which covers the problems posed in the Corps of Engineers Data Book insofar as they are applicable to the State of Delaware. Over one hundred problems are listed in the outline. He stated that Delaware's report will be based upon many cooperative reports and will represent the "sense of the group".

Dr. Kaplovsky expressed grave concern regarding water availability because of the patterns of growth indicated in the lower Delaware basin. He reiterated the vital interest of southern New Jersey and Delaware in the river and the activities within the reaches of the river and its tributaries beyond tidal range.

Mr. Vopelak, as observer for the State of New York, had no report.

#### 20. REPORTS BY THE CITIES

Mr. Arnold, on behalf of Philadelphia, expressed a deep interest in the studies of future domestic water requirements, and also in the pollution studies because of the problems in the Philadelphia filter stations. He promised every cooperation from the city authorities.

Mr. Terenzio, on behalf of New York City, reviewed the history of the Board of Water Supply activities in the upper basin. He stated two reservoirs had been completed and are in use, and a third one is under construction. The City of New York has been in a position to bring relief from the low flow in the Delaware, caused by the present drought, through releases from the City's reservoirs. He said the Corps of Engineers had frequently consulted his organization with respect to the availability of data on the upper basin and that there had been cooperation on both sides. He expressed the City's wish to be of service in the future, particularly because of the large fund of experience the Board of Water Supply has had. Mr. Goddard noted that on 9 August, two-thirds of the Delaware's flow at Montague came from one-tenth of the watershed. Much of this he attributed to the New York City reservoir releases.

#### 21. REPORT - OFFICE OF BUSINESS ECONOMICS

Mr. Graham, on behalf of the Office of Business Economics, stated that the national projections had been completed and that work on the regional projections was underway. He expected to have complete figures for the nation and the sub-areas of the basin by the end of September 1957 and to make the preliminary figures available to those who need them. Mr. Graham gave an explanation of the term "personal income". Col. Clark suggested that the preliminary figures by the Office of Business Economics be an item in the agenda for the next meeting.

#### 22. COMMENT - DELAWARE RIVER BASIN ADVISORY COMMITTEE

Mr. Walter M. Phillips, Executive Secretary, informed the Committee that Delaware River Basin Research Inc. had entered into a contract with Syracuse University to make a study with funds provided by the Ford Foundation in the amount of \$131,000. He outlined the following four steps in that study:

- a. The kind of organization that is needed for the proper development of the Delaware River basin.
- b. The kind of financing necessary to carry it out.
- c. The local implementation plan.
- d. The other types of implementation necessary to put the plan across.



He stated that his Committee had decided to focus attention on materials being furnished by participating agencies in order to encourage comprehensive treatment, to keep abreast of the nature of the studies being made and to assure the Committee that all pertinent fields are being covered adequately. He stated the Research Corporation may consider additional research to supplement the survey effort.

#### 23. COMMENT - INTERSTATE COMMISSION ON THE DELAWARE RIVER BASIN

Mr. Francis A. Pitkin, Chairman of INCODEL, remarked that his Commission is greatly impressed by the magnitude of the tasks still to be done to complete the survey. For himself, as a single member of INCODEL, he hoped serious consideration would be given to the possibility of completing an interim report on one reservoir ahead of the presently planned schedule for a report on the entire survey. Col. Clark promised that consideration would be given to this suggestion. Mr. Pitkin invited all present to attend the annual meeting of INCODEL at Pocono Manor, Pa. in September.

#### 24. REPORT ON WATER AVAILABILITY

Mr. Morgan, on behalf of the Corps of Engineers, presented a report on water availability which is attached to these minutes as Appendix G.

In answer to questions, Mr. Morgan pointed out that the critical low flow period was between 1930-1934 and that the data in this study does not include the 1955 high flows. He further stated that the sites for this analysis were picked on the basis of their practicability; that the study has not been completely detailed but that the report will probably indicate some kind of a program development time-wise for the accumulation of storage in the basin. These requirements do not as yet consider the effects of the upstream auxiliary reservoirs that are being studied. He noted that the best place in the basin for water storage is the area between Fishs Eddy and Port Jervis; that the area above Fishs Eddy contributes 30% of the flow and requires 39% of the storage; that no drought frequencies have been assigned to any of the points in this study; and that figures on acreages to be inundated are available but have not been totalled.

#### 25. REPORT ON UNIT HYDROGRAPHS

Mr. Marshall R. Iakisch of the Corps of Engineers made a report on unit hydrographs, a copy of which is attached to these minutes as Appendix H.

In answer to questions raised by Mr. Shanklin, Mr. Iakisch stated that the published unit hydrographs are the average unit hydrographs as determined from three to five or six storms; that the unit hydrographs have been checked to make sure that they would reproduce the individual runoff hydrographs from which they were derived; and that the generation period would be different in every storm and is, in effect, the time of duration of rainfall excess.

Mr. Larson stated that, in his opinion, the various agencies were not approaching the problem from the same direction; the Forest Service has gone out in wooded areas to determine its findings relative to characteristics affecting run-off; the Soil Conservation Service has compiled soil surveys and soil cover characteristics; the Valley Report Group plans to relate the unit hydrographs to basin characteristics and complete such studies within the next month. The U. S. Geological Survey has recently requested copies of the Soil Conservation Service's soil surveys. Mr. Larson stated that correlation between the Corps of Engineers and the Soil Conservation Service is necessary and these matters would be taken up at the Hydrology Group meeting to be held on 30 September. Col. Clark said that there was a great deal of integration needed by all agencies before these studies could be completed.

Mr. Morgan stated that basin shape factors are the standard characteristics used by the geophysicists in relating characteristics of the run-off hydrographs to basins and all agencies are using these same terms. Mr. Larson commented that the Soil Conservation Service had always contended that soil and cover have an influence on runoff. Mr. Shanklin remarked that studies conducted by the State of New Jersey indicated that soil characteristics are more important on the smaller watersheds and that for larger watersheds, the basin characteristics, such as shape and slope, are the controlling features. Col. Clark stated that the Coordinating Committee was responsible for the various agencies correlating their studies.

## 26. REPORT ON FLOW FREQUENCIES

Mr. Iakisch also presented a discussion on the flow frequencies in the Delaware River basin, a copy of which is attached as Appendix I.

Mr. Iakisch said that annual peak flows were used to determine Beard's plotting position and also to compute a statistical frequency curve. However, peak flows from hurricane-type storms were computed analytically on a tri-annual basis and converted to an annual series by using the probability formula. Maps of hurricane traces prepared by the Office of Climatology, U. S. Weather Bureau, were used in studying the general paths of hurricanes along the northeast section of the

Atlantic coast. Mr. Terenzio wanted to know if there is any tendency to change which would affect the curves in our projections fifty years hence. Col. Clark stated that our work has not progressed sufficiently to establish any definite information. However, he stated that we obtain our hurricane data from the Weather Bureau and before we are finished with the report, the Weather Bureau and other agencies will come up with the answers.

#### 27. REPORT ON GROUND WATER & SEDIMENTATION STUDIES

Mr. F. H. Olmsted, of the U. S. Geological Survey, presented a talk, illustrated with slides, on ground water and sedimentation studies in the Delaware River basin. A resume of this talk is attached to these minutes as Appendix J.

Mr. Larson expressed interest in sedimentation volume. He hoped that coordination could be achieved with respect to information on sedimentation storage in small reservoirs. Mr. Olmsted stated that estimates would have to be made for such reservoirs.

#### 28. FEATURES AND OPERATION OF FISHWAYS

Mr. G. B. Talbot, of the Bureau of Commercial Fisheries, stationed at the U. S. Fishery Laboratory in Beaufort, North Carolina, gave an interesting talk on factors and considerations governing the necessary features and operation of fishways. The report contained much more detailed information than can be reproduced within the scope of these minutes. It was illustrated by slides showing examples of various types of fishway construction in different parts of the United States.

#### 29. SUGGESTIONS FOR TOPICS FOR NEXT MEETING

Col. Clark requested information regarding technical papers and their usefulness at future meetings. Mr. Arnold thought they were valuable and gave the members an opportunity to see what was actually being done. Mr. Goddard agreed. Mr. Spellman suggested that distribution prior to the meeting would assist the members in formulating questions, thus speeding up the meeting. Col. Clark stated he felt the Committee agreed that a limited number of technical papers would be a good thing; that they give the members a chance to see some of the basic problems that go into the report and give Committee members a chance to meet and talk to some of the people who are doing the basic technical work.

Col. Clark stated it was time to have a joint report from the Soil Conservation Service and the Corps of Engineers relative to upstream auxiliary reservoirs, and requested that one be prepared for the next meeting.

Col. Clark stated that one of the things of importance in basin planning is the impact of state laws pertaining to water resources policy and, in view of this, it was his good fortune to have been invited to a meeting at Ann Arbor, Michigan, in September, to discuss water policy laws, on which he will make a report to the Committee. He expected to ask each of the states of the basin for a report on their laws bearing on water resource development. He further stated that the problem of coordination is a pressing one. From the quantity of material being covered, he said it appeared as though it will grow to a flood very shortly and that the Corps of Engineers must have the help of everyone connected with the survey for effective coordination.

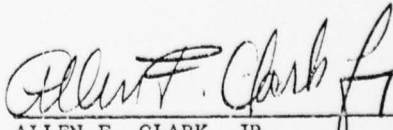
Mr. Shanklin suggested flood plain zoning and flood insurance as subjects for the next meeting. Col. Clark thought the states should look into these subjects through their law-making bodies.

### 30. PLANS FOR FUTURE MEETINGS

Col. Clark brought up the matter of when and where to hold the next meeting. He expressed the hope that a suitable place in Delaware could be agreed upon, and that late October or early November would be agreeable. He asked permission to assume the responsibility of choosing the next time and place.

Mr. Martin thought the Committee should meet more frequently. Col. Clark said he was reluctant to agree to this because everyone was busy and he thought sufficient material was not yet available for more frequent meetings; that when the Committee next met, it should be in a position to put its fingers on the spots where coordination is most needed. Dr. Kaplovsky suggested sub-committee work for specific problems. Col. Clark agreed that work group reports would be helpful.

Col. Clark stated that a great deal of progress has been made at this meeting and he adjourned it at 12:50 P.M. on 16 August 1957.

  
ALLEN F. CLARK, JR.  
Colonel, Corps of Engineers  
Chairman



\* MINUTES OF THE THIRD MEETING  
of the  
DELAWARE BASIN SURVEY COORDINATING COMMITTEE  
HELD 14-15 NOVEMBER 1957  
at  
WILMINGTON, DELAWARE

1. OPENING REMARKS. The Committee was convened in the Nemours Auditorium, Wilmington, Delaware, at 9:30 A.M. on 14 November 1957, by Col. Allen F. Clark, Jr., Chairman. The Chairman acknowledged the efforts of Brig. Gen. Norman M. Lack, Ret., in obtaining the auditorium for the meeting, and Mr. Granville M. Read's sponsorship for the meeting to be held there. He also thanked Mr. B. W. Reese and his staff, for making the necessary arrangements in the auditorium to facilitate the conducting of the meeting.

2. INTRODUCTIONS. a. Colonel Clark informed the Committee of his transfer to the west coast and introduced Colonel William F. Powers, his successor. He also introduced Mr. E. W. Landenberger, representative from Office of the Chief of Engineers, and Mr. James R. Johnston, from the Division Office, North Atlantic.

b. The Chairman then introduced the members of the Coordinating Committee and expressed his regret on the passing of Major Irving V. A. Huie. He advised that Mr. Arthur C. Ford has been appointed President of the New York City Board of Water Supply as Major Huie's successor. Mr. Ford was unable to be present at the opening of the meeting. The Chairman also introduced Mr. Alvin C. Watson who replaced Mr. Fred H. Larson as the member representing the Department of Agriculture.

c. The following members and alternates were present:  
Mr. Richard Ackroyd, for Mr. S. L. Taylor, Dept. of Commerce  
Mr. Samuel S. Baxter, City of Philadelphia (on 14th)  
Mr. B. Budd Chavooshian, for Mr. Joseph E. McLean, State of New Jersey (part time)  
Col. Allen F. Clark, Jr., Chairman, Dept. of the Army (on 14th)  
Mr. Arthur C. Ford, City of New York (part time)  
Mr. D. R. Gascoyne, Dept. of the Interior  
Mr. Carl B. Harr, for Mr. John F. Foy, Dept. of Labor  
Dr. A. Joel Kaplovsky, for Mr. Richard A. Haber, State of Delaware  
Mr. Lester M. Klashman, for Mr. Sylvan C. Martin, Dept. of Health, Education and Welfare (on 14th)  
Mr. Sylvan C. Martin, Dept. of Health, Education and Welfare (on 15th)  
Mr. Joseph E. McLean, State of New Jersey (part time)  
Mr. Bernard D. Murphy, for Mr. Maurice K. Goddard, Commonwealth of Pennsylvania  
Col. William F. Powers, Chairman, Dept. of the Army (on 15th)

\* See minutes of next meeting for corrections.

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ARMY ENGINEER DISTRICT PHILADELPHIA PA  
REPORT ON THE COMPREHENSIVE SURVEY OF THE WATER RESOURCES OF TH--ETC(U)  
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Mr. John H. Spellman, Federal Power Commission  
Mr. Vincent G. Terenzio, for Mr. Arthur C. Ford, City of New York  
(part time)  
Mr. Alvin C. Watson, Dept. of Agriculture

d. In noting the absence of a representative from the State of New York, the Chairman explained that Mr. Thorndike Saville, Member, was out of the country, and that Mr. Ronald B. Peterson, his alternate, was recovering from illness.

3. COMMENTS ON MINUTES OF PREVIOUS MEETING. a. The following changes were requested in the minutes of the 2d Meeting which was held at Bethlehem, Pa. on 15-16 August:

(1) Mr. V. G. Terenzio requested that a change be made on Page 4, Item 6, next to the last sentence of paragraph 3, as follows: "New York City reservoirs release substantial amounts of water downstream and the authorities are mindful of recreational needs and benefits; however, they find that complaints are made that the draw-down at reservoirs is detrimental to recreational use."

(2) Mr. Richard Ackroyd requested that the name "Mr. Jenner" be deleted from first line and fifth line of the last paragraph of Item 13 on Page 8, and "Mr. Ackroyd" substituted.

(3) Mr. John H. Spellman requested that the last paragraph of Item 14 on Page 9 be rephrased to bring out the answer to the question. Delete "and the answer was 'neither' and add "and the answer was that the preliminary estimates were developed as a projection of the trend of rates of growth since estimates of population and industrial development extending to the year 2010 are not available."

b. The minutes were approved, subject to the above cited changes.

4. ADMINISTRATIVE ANNOUNCEMENT. The Chairman requested that agencies which are furnished copies of reports for review exert every reasonable effort to submit their comments by the date indicated in the letter of transmittal in order that their comments may receive consideration, and completion of the report may not be delayed.

5. PRINCIPLES OF ECONOMIC APPRAISAL. Lt. Col. Frank A. Gerig, Jr. of the District Engineer's staff, presented a paper on the general principles and procedures of economic appraisal of water resources development. It was pointed out that the benefits of such appraisal can be divided into tangible benefits, those which can reasonably be given a monetary value, and intangible benefits which can be described in appropriate terms and may influence recommendations of the report.

After a discussion of costs included in project analysis, he touched briefly on the principles and past practices of cost allocation to the various purposes of multiple-purpose projects. The Separable Costs-Remaining Benefits method of cost allocation was described and a hypothetical example was presented which showed application of this method. It was specifically pointed out that values expressed, percentages used, and costs allocated to the various purposes were hypothetical only and were selected to illustrate various aspects of procedure. The paper presented is attached as Appendix A to these minutes.

6. STATUS REPORT - CORPS OF ENGINEERS. Mr. Russell Morgan, Chief of the Valley Report Group of the District Engineer's organization, reported on the status of work in the Philadelphia District. Although there were still some troublesome vacancies in his organization, his hydrologic staff has continued work on all the studies which it has had under way for the past 1½ years. The basic hydrologic work, consisting of such items as unit hydrographs, peak flow frequencies, flood routing procedures and diagrams of mass flow, have just about been completed. Also, some additional work has been done on the water availability studies, which were reported on at the previous meeting. In this additional work, more detailed consideration was given to the sub-watersheds. A study of low flow frequencies has been started and a drought frequency study is scheduled for completion in the next few months. The Group's personnel also participated in the Corps of Engineers-Soil Conservation Service Joint Work Group's week-long session to establish hydrologic criteria for fixing storage, spillway and outlet capacities for the upstream auxiliary reservoirs. The planning staff defined detailed flood damage curves for four reaches of the Delaware. This type of work is being continued for the tributaries. The flood damage curves are being based on data collected after the occurrence of hurricane "Dianne" in August 1955. The design staff has been compiling data on dam sites being considered, laying out projects for these sites as bases for cost estimates, and making field investigations for the upstream auxiliary reservoirs. Work on quantity and cost estimates is in progress. On 7-8 November, a workshop conference was held, in the District Engineer's office, on the subject of "Monetary Appraisals of the Effects of Multi-Purpose Projects in the Delaware River Basin." There were 33 persons present representing 11 different agencies and organizations cooperating in the studies. The following major subjects were covered: planning procedures; monetary appraisals applicable to flood flow regulations; monetary appraisals applicable to low flow regulations; and monetary appraisals applicable to reservoir pools. Basically the conference was exploratory; it brought out who was interested in which appraisals and clarified why the Corps must obtain and use monetary values in the report. In the initial consideration of project benefit evaluations, approximate methods of appraisals will be applied. Data on sites to be studied and appraised initially by the various agencies will be distributed shortly after the first of next January.



7. STATUS REPORT - FEDERAL POWER COMMISSION. Mr. Spellman introduced Messers Frank L. Weaver, Lazar B. Woll and Kenneth W. Ross, key members of the Commission's staff. He then brought up to date his report made at the previous meeting, on the status of action, by the Commission, on the request of the Delaware River Development Corporation to withdraw its application for a preliminary permit for a power project at Tocks Island. In accordance with the recommendation of its staff, the Commission had informed the applicant on 15 August 1957 that the request for withdrawal has been granted without prejudice and that the applicant would be permitted to apply at any time in the future. With respect to the comprehensive survey, the Commission has continued development of the basic data required to estimate the future power requirements of the selected market area. Mr. Spellman and Mr. Weaver had attended a meeting of the Delaware River Basin Advisory Committee at which there were discussions of the power aspects of the comprehensive survey, the undeveloped water power surveys which have been published by the Commission, and various other matters pertaining to power and water storage. How much power may be developed in the plan that will come out of the survey is not yet known, but the Commission is giving attention to attempts to develop power in such a way that it would be compatible with other water uses. Power values are being developed for the use of the Corps of Engineers in its economic evaluation of projects. The Commission is also continuing its interest in the idea of pumped storage.

8. STATUS REPORT - DEPARTMENT OF AGRICULTURE. Mr. Alvin C. Watson reported on the status of the work being performed by the agencies of the Department of Agriculture. Work is in progress on the manuscript covering agriculture in the Delaware basin. Certain parts of the manuscript are nearing completion and are expected to be ready for submission to the Corps in about 6 to 8 weeks. The study of land use and cover conditions is complete and the results are being summarized. The studies of irrigation and domestic water uses have been completed, but the manuscript has not been started. The SCS representatives on the Corps of Engineers-SCS Joint Work Group are continuing their studies of the upstream auxiliary reservoirs. Studies are being made of sample sites in sample sub-watersheds, and the results will be projected to other sites. Such a procedure requires careful selection of sample sub-watersheds, consideration of type and quality of run-off data, and type and quality of rainfall data. The work group has identified 338 sites and examined them in the field. Serious obstacles to construction have been noted.

9. STATUS REPORT - C. OF E.-SCS JOINT WORK GROUP. a. Mr. John Tinivell of the Soil Conservation Service was called upon by the Chairman to make a report on the status of the studies on upstream auxiliary reservoirs by the Joint Work Group composed of representatives of the Corps of Engineers and the Soil Conservation Service. Mr. Tinivell's report is Appendix B.

b. Mr. W. Brinton Whitall of the staff of Delaware River Basin Advisory Committee, referring to the mention made by Mr. Tinivell of the division of the Delaware basin into 10 sub-areas by the Joint Work Group to facilitate its studies, stated that various agencies are using different breakdowns of the basin area for their respective studies, and questioned the possibility of coordination or consistency in this matter. The Chairman designated Col. Gerig to again explore the extent of possible problems which may arise from different methods of subdividing the basin and effect such coordinating action as is feasible.

10. STATUS REPORT - DEPARTMENT OF COMMERCE. a. Mr. Richard Ackroyd reported for the Weather Bureau that preliminary average annual and seasonal free-water evaporation maps and a preliminary average annual precipitation map are completed. An average annual temperature map is nearly completed, and when completed, the free-water evaporation computations will be reviewed and a final annual free-water evaporation map will be prepared.

b. Mr. Ackroyd also reported for the Bureau of Public Roads, stating that it had offered to furnish, upon request, any highway location information that the agencies participating in the survey may desire. It was stated that inasmuch as the interstate highway from Scranton to Port Jervis is not yet located, it would be to the mutual advantage of the project planners for the survey and the Bureau of Public Roads to know where installations may be proposed or located and any other information which would affect that highway. The interstate route from Binghamton south to Stroudsburg has not been built so changes can be made. All other routes are on definite location.

11. STATUS REPORT - PUBLIC HEALTH SERVICE. a. Mr. Lester Klashman, representing the Public Health Service, stated that his agency's preliminary report, consisting of two sections, viz., one on the inventory of municipal and industrial water use, and the other on stream quality, was being reviewed by the respective work groups. Although comments had not yet been received from all members of the work groups, the draft was being edited and revised. Meetings of the work groups will be held, after all comments are received, to discuss proposed revisions. Subsequently, the revised report will be forwarded to the District Engineer for distribution to the Coordinating Committee and to the participating agencies. The Service's "Summary Report on Insects of Public Health Importance in the Delaware Basin" was submitted to the District Engineer and distributed by him for comment to the Committee members and the participating agencies concerned. Five replies have been received.

b. During the summer, with the aid of a temporarily supplemented staff, an extensive survey of stream quality was completed for that section of the Delaware basin between Port Jervis and Trenton.

Numerous samples were collected at various points along the main stem and on a number of the tributaries. More than 1,000 analyses were performed. Additional samples were analyzed by the state laboratories of New Jersey and Pennsylvania. Several slides were shown illustrating the field sampling and testing techniques. The results of the survey are now being analyzed and a detailed report summarizing the results is expected to be completed late in December or shortly thereafter. In addition to the stream quality survey, studies were made of industrial water use and industrial waste discharge in New Jersey and Pennsylvania with the aid and cooperation of the state agencies concerned. The Pennsylvania Department of Health made available a large part of its Industrial Waste Section for this part of the program. The results of these studies are being analyzed and they will be incorporated in the report on the stream quality field survey. In addition to these activities, existing survey data are being evaluated and newly accumulated data are being integrated for use in preparation of the final report due in 1959.

12. STATUS REPORT - DEPARTMENT OF THE INTERIOR. a. Mr. D. R. Gascoyne reported on the activities of the Geological Survey, the Fish and Wildlife Service, and the National Park Service. A detailed report was given on the status of topographic and geologic mapping and investigations in the basin which are, generally, normal functions of the Geological Survey, and special studies on ground water resources and the sediment load in stream. A preliminary report on the special studies was submitted to the District Engineer, and is being revised. Because the hydrology and water resources of the basin merit thorough comprehensive treatment, the revised report, for use by the Corps of Engineers, will include a generalized analysis of basin-wide water resources in relation to the physical environment. The report is expected to be published in fiscal year 1959.

b. The Fish and Wildlife Service, recently reorganized, now consists of two bureaus - the Bureau of Commercial Fisheries and the Bureau of Sport Fisheries and Wildlife. The latter bureau is representing the service in the Delaware River basin survey and is coordinating its activities with the Bureau of Commercial Fisheries. The fishery resource inventory, reported on at the second meeting, is virtually completed. The same pattern will be used in the waterfowl inventory and the aquatic fur animal inventory which are now under way. Biologists of the Service are coordinating and compiling data, furnished by the conservation departments of the four states concerned, for inclusion in the final report. Expansions of industry and population have caused reduction in the fish and wildlife habitat in nearly all sections of the watershed with consequent reduction in recreational opportunities.



c. The National Park Service has conducted meetings with each State Coordinator, and, as a result, survey procedures were agreed upon. Study teams will work directly with the state and local agencies concerned. Background material, including an inventory of existing public non-urban outdoor recreational areas and facilities, has been drafted. Data on existing private or commercial recreation areas, existing water areas possibly suitable and available for public recreation, sites containing outstanding or rare examples of natural history features considered worthy of conservation, and potential non-urban recreational areas that have been suggested, proposed or recommended for conservation and development for park or recreation purposes are being gathered. A poll, on a sampling basis, is being conducted to determine non-urban recreational activities and desires of the people of the basin and the adjacent New Jersey areas. Much work has been accomplished in connection with the historical phase of recreational resources.

d. Although the Bureau of Mines, the fourth bureau, has received no funds for the Delaware studies, it is maintaining its interest in the survey and keeping informed on progress.

13. STATUS REPORT - OFFICE OF BUSINESS ECONOMICS. a. Mr. Robert E. Graham reported that preliminary projections for the survey were transmitted to the District Engineer on 5 November, who reproduced them, and that they were in the process of distribution to the various agencies participating in the survey which need them for planning purposes. He indicated that the material is preliminary in the sense that the results need to be compared with those obtained by other methods of analysis and more checking needs to be done in order to achieve entire consistency. While changes are to be expected in certain details of the preliminary projections as a result of further work by OBE, Mr. Graham was confident that the conclusions presented in the preliminary report will still be valid when their final report is completed.

b. The factors presented in the preliminary report are in effect the "economic dimensions" of this area in terms of population, employment, households, gross national product and personal income. A brief explanation was given of the procedure used in making the projections. In response to a question of public relations aspect, Mr. Graham stated that the projections had not been compared with any of those made by city planning commissions or state planning boards; however, OBE would like to have projections which have been made locally.

c. The Chairman stated that the projections are fundamental to all the planning being done for the future, and that in their preliminary form, they are not for public information but for the use of those agencies which have actual need for them in their studies for the survey.



14. STATEMENT ON SUBMITTING A SEPARATE REPORT ON TOCKS ISLAND.

a. Colonel Clark reported that serious consideration had been given to a suggestion, made at the previous meeting by Mr. Francis A. Pitkin, that a separate report on a project at Tocks Island be submitted. It was indicated that the preparation of such a report would delay completion of the report on the comprehensive plan by approximately 12 months, due to the lack of sufficient staff to work on both reports concurrently. In addition, the overall cost of the survey would be increased materially because the findings in the separate report would need to be reanalyzed before they could be included in the comprehensive report. To proceed with a separate report, it would be necessary to assume that a project at Tocks Island was the cheapest one. Colonel Clark stated that although he had no doubt that the project would be built by someone, he was unwilling to make the assumption as to whether or not it would be the first item recommended for construction under the comprehensive plan.

b. Colonel Clark observed that if a separate report were submitted on Tocks Island, the benefits assigned to such a project might not be the same as the benefits assigned under a comprehensive plan, and therefore might preclude adoption of a possibly more economical approach in an overall plan for best uses of the waters of the Delaware. Another factor for consideration is that the submission of a separate or interim report on Tocks Island would present to Congress a tentative or preliminary set of values on one element for development of the basin, whereas, Congress requested a comprehensive plan.

c. In view of the foregoing, Colonel Clark concluded that preparation of an interim report could not, in his opinion, be justified.

d. Mr. James H. Allen remarked that at the time Mr. Pitkin made his suggestion, he was not aware that it would be necessary to interrupt the work on the comprehensive plan, and now in view of this fact, he and Mr. Pitkin were willing to go along with Colonel Clark's decision.

15. MICHIGAN CONFERENCE ON MODEL WATER LAW. a. At the previous meeting of this Committee held at Lehigh University, Colonel Clark stated he would report at this meeting the results of the conference held at Ann Arbor, Michigan, on 4, 5 and 6 September 1957. Colonel Clark stated that the purpose of the conference was to discuss a Model Water Use Act which had been promulgated by the University of Michigan Law School and which was presented in its third tentative draft. Of singular importance was the fact that the conference leaders brought together a wide range of representatives of the legal and engineering professions, who were interested in the problems of water resources development, in order to explore with them the problems inherent in such development. It is the hope of the Michigan group to resolve the conflicts in order that water resources development in the United States might proceed on an orderly basis.

b. For the purpose of the Model Water Use Act, water was divided into two categories; namely, surface water and ground water. The act is designed primarily for a riparian doctrine area, but could be utilized by an area operating under the appropriation doctrine. It provided that the state should establish a water control commission which would have considerable authority. Colonel Clark indicated that the State of Iowa has enacted a law similar to the Model Water Use Act.

c. The opportunity to discuss the Water Use Act was taken to show one of the endeavors which is being carried forward in the field of water resources law. It is widely felt that there is a great deal yet to be done. In the light of that and the present interest in water laws, Colonel Clark remarked that the statements on state laws to be made by the state representatives at this meeting should be of special interest.

16. DOWNSTREAM WATER NEEDS. a. Mr. Samuel S. Baxter discussed the City's plan for continued use of its filter plants which draw water from the Delaware and the Schuylkill. Three existing installations are scheduled for complete modernization as rapid sand plants. Unless the quality of raw water in the two rivers deteriorates considerably, the use of these plants will be the most economical way to supply the demand; therefore, it is the City's view that any plans for the future should provide for maintaining or improving the present quality of the water in the Delaware and its tributaries. Philadelphia plans to continue the use of the Schuylkill River for some indefinite time into the future and has recently requested the State to increase its allocation therefrom from 200 million gallons per day to 258 mgd. Concurrently, the Philadelphia Suburban Water Company has requested the State for an allocation of 20 mgd from the Schuylkill River to supplement its present supply from small streams which proved inadequate during the past summer. The ultimate approved plan must provide for Philadelphia's future average annual daily requirements of 500 million gallons of raw water and a maximum daily requirement of 620 million gallons. If some type of local storage is available, the maximum amount might never be required to be taken from the stream on any one day. It is the view of the Philadelphia Water Department that the most important use of the Delaware River is its being a source of water for public water supplies.

b. In addition to the matter of the quantity of water which is available, there is the factor of quality. The degree and kind of pollution which exists in the lower basin is of great importance and must be considered with minimum river flow for dilution; therefore, consideration should be given to a combination of minimum water quality levels and specified minimum flows, where quality would be appraised from the standpoint of both pollution and salinity. Consideration of flow rates alone is inadequate in determining the health of the river; yet a large number of samples is being taken and observations of various factors affecting quality are being made now, and probably will be continued in the future.

Inasmuch as there seems to be no interstate or federal agency to integrate and monitor this information, Mr. Baxter suggested that the River Master become a monitor and notify all concerned of dangerous or critical conditions which arise or are about to arise. Items suggested for observation included temperature, biochemical oxygen demand, dissolved oxygen, pH (hydrogen ion concentration), sediment, radioactivity, salinity and ecological balance. Philadelphia's position was stated to be that the City, as the largest metropolitan area on the Delaware River, has a right to all the water it needs, consistent with the rights of others within the basin. Philadelphia also wants assurance that when conditions require it, or when its people desire it, the City can go to upland sources on the River and obtain the water it needs. At the present time, the City has no plan for building storage reservoirs to meet future demands; it prefers to rely upon the lower basin in its present, or improved, condition as a source of supply.

17. RESOLUTION IN HONOR OF COLONEL ALLEN F. CLARK, JR. a. Upon completion of the business scheduled for the first day of the meeting Mr. Joseph E. McLean proposed the following resolution:

"WHEREAS: Colonel Allen F. Clark, Jr., is now being transferred from the U. S. Army Engineer District, Philadelphia; and

"WHEREAS: he has served with distinction as Chairman, Delaware Basin Survey Coordinating Committee; and

"WHEREAS: in all of his associations with officials and citizens of the Delaware Valley, he has displayed rare qualities of tact, integrity and imagination, and great administrative capacity as well;

"THEREFORE BE IT RESOLVED: That the members and citizens attending this meeting of the Delaware Basin Survey Coordinating Committee do hereby express their appreciation to Colonel Clark for his distinguished public service to his Country and to the people and institutions of this Valley, and that they herewith extend to him their congratulations and best wishes on his new professional assignment; and further that they add this one note of envy and regret: 'Columbia Valley's gain is Delaware Valley's loss'."

b. The sense of the meeting was to adopt the resolution and to make it a part of the minutes. Colonel Clark expressed his gratitude to the members of the Committee and the observers present for the resolution honoring him.

18. TRANSFER OF CHAIRMANSHIP AND RECESS Colonel Clark expressed his appreciation to the members of the Committee and to all the participating agencies for their cooperation in the survey. He felt that a most encouraging start had been made in this survey, which to the best



of his knowledge was the finest example of cooperation among the Federal agencies, the states and the cities. Colonel Clark relinquished the chairmanship of the Committee by handing the gavel to Colonel Powers, expressing his sincere hope that the survey would be carried to a successful conclusion and in accordance with the schedule. Colonel Powers stated he realized that there were many inherent complications in an undertaking such as this, but nevertheless he welcomed the opportunity to direct the survey and to work with the Committee and all parties concerned. As Chairman, Colonel Powers recessed the meeting until the following day.

19. STATEMENT FOR THE CITY OF NEW YORK. Colonel Powers introduced Mr. Ford who succeeded the late Major Irving V. A. Huie as President of the Board of Water Supply for the City of New York and as a member of the Coordinating Committee. Mr. Ford expressed his pleasure in becoming a member and his regret on the circumstances which led to it. He stated that the people of New York City have already indicated their high appraisal of the Delaware basin by the developments they have undertaken and by bearing the costs for the benefits derived. With two-thirds of the plan in operation and despite diversions out of the basin, Mr. Ford said operations were such that flow in the main stem showed improvement for the past four months, although on 24 separate days the natural flow at Trenton dropped to an all time low since 1920. He held that uses and benefits arising from the development of the water resources of the basin need to be shared and that when the preliminary results of the comprehensive study are available, each benefiting segment of the public must be informed what it can expect from the plan and what its share of the cost will be. Mr. Ford pledged his cooperation and the support of the Board of Water Supply, and expressed the opinion that the Corps has shown remarkable achievement.

20. REPORT ON DEFINITION OF POLLUTION. The Chairman referred to the question regarding the definition of "pollution" which arose at the previous meeting, and which led to the request that Health Service representatives and Fish and Game representatives, Federal and State, form a committee under Mr. Martin to discuss and resolve the question of definition and report to the full committee at the next meeting. Mr. Martin reported that a diligent effort had been made to assemble those concerned, but due to prior commitments, a meeting of their group could not be held before this meeting. Mr. Martin had discussed the question with Messrs. Gascoyne and Russell Norris of the Fish and Wildlife Service, and basically there is no disagreement between the Health group and the Fish and Game group. All concerned indicated that they are willing to get together, and the meeting will be held in Philadelphia on 10 December 1957. Mr. Martin stated that he would report at the next Coordinating Committee meeting the results of coordination on the meaning of the term "pollution."



21. STATEMENT OF POLICY ON RECREATIONAL USE OF RESERVOIRS BUILT UNDER PUBLIC LAW NO. 566. Mr. Alvin C. Watson, of the Department of Agriculture, discussed the subject of recreation in connection with reservoirs built under the small watershed program. Mr. Watson's remarks are contained in Appendix C hereto.

22. STATEMENT ON STATE LAWS GOVERNING WATER RESOURCE DEVELOPMENT, AND STATE LAWS AND POLICIES RELATIVE TO LAND ACQUISITION, INCLUDING FLOOD PLAIN ZONING AND FLOOD INSURANCE. The presentation of these statements was suggested at the previous meeting. In accordance with the request of the Chairman, the members from the four states submitted copies of their respective statements for distribution to all the other members prior to this meeting. The distribution was made, and therefore only briefs of those statements are presented herein.

23. STATEMENT FOR THE STATE OF NEW YORK. Inasmuch as the State of New York was not represented at this meeting, the Chairman requested Lt. Colonel Gerig to read the report entitled "Commissions Study Flood Plain Zoning" submitted by Mr. Ronald B. Peterson, alternate, which was published previously in the New York State Planning News. The report gives recognition to the problems to be encountered and resolved when a legislative body considers the task of eliminating or reducing the devastating effects of floods. It suggests three separate fields to be studied; namely, (a) preventing obstruction of the channel; (b) limiting public use; and (c) restricting private use. Aside from the above requirements of land use restriction, the report states that the community has a stake in the regulation of land use on the flood plain. It is the community which bears the cost of flood relief and rehabilitation. The planning committee which recommended that the State add to its city, village, and town laws a specific statement that one of the "purposes in view" of zoning should be to secure safety from flood, also studied the constitutionality of such a purpose. It seems certain that the same considerations of the police power which have so often sufficed to support other zoning laws, would permit flood-plain zoning. In a letter dated 12 November 1957, Mr. Peterson stated that the New York State Joint Legislative Committee on Natural Resources has instituted a Special Advisory Committee on Water Resources and Water Rights. This Committee is currently engaged in a study of the State's basic water laws and will ultimately recommend such changes in State laws as appear to be required. There is a distinct possibility that some of this new legislation may be introduced in the 1958 session of the legislature.

24. STATEMENT FOR THE STATE OF DELAWARE. The paper prepared by the State of Delaware Coordinating Committee and presented by Dr. A. Joel Kaplovsky summarized the laws and policies governing development of water resources, including comments on flood-plain zoning and insurance. The various groups which have studied Delaware's water-right laws have presented similar findings, one of which states that, "The Delaware water-right laws need clarification and possibly also some

modification. But in view of the complexity of the problems and the several alternative solutions that have been tried in other states, thorough study and discussion of various phases and possible solutions of such problems are advisable before any new legislation is adopted." A water resources committee created on 15 December 1954 reviewed the water use and conservation problems within the state and submitted its reports to the Governor on 2 May 1956. As a result of these reports a bill for creating a Water Resources Commission was subsequently submitted to the General Assembly during its 1956 session. It has not as yet been enacted into law. Should it pass, the resultant Water Resources Commission would control the taking of water or the diversion thereof from the various state waters, both ground and surface. There would be a modification of the riparian doctrine to one of reasonable use. Land acquisition for water development projects may be carried out by several state interests; namely, the Highway Department, the Game and Fish Commission, the New Castle Levy Court and the City of Wilmington. The State Highway Department is authorized to study and construct flood control measures along Little Mill Creek in Christina Hundred under an act passed 28 June 1957. The New Castle County Regional Planning Commission is directed to safeguard the well-being of the County which includes drainage as well as other improvements. The Delaware representative expressed the view that the control of storm water must be considered of public interest and with the expected expansion in population and development in Delaware within the next 50 or 100 years, flood-plain zoning on a state-wide basis is vitally needed.

25. STATEMENT FOR THE STATE OF NEW JERSEY. The paper prepared for the State of New Jersey was presented by Mr. Joseph E. McLean. The basic water-right law for private use of both surface and ground waters in New Jersey is the riparian doctrine as developed under the common law, modified by court decisions, in the case of ground water to consider reasonable use, and in the case of surface water for irrigation to consider beneficial use. In addition, a statute was passed in 1947 which further modifies the riparian doctrine as it pertains to private use of ground water. There is no state control at present over private use of surface water for either consumptive or non-consumptive use. Legislation to this effect, patterned on the principles and procedures set forth in the private ground water statute passed in 1947, is under study by the Department of Conservation and Economic Development and the Department of Agriculture. Under statute in New Jersey, the state control of use of surface and ground water for public potable water supply wherein the water is used off the property on which it is obtained and sold as merchandise, is based on the police powers of the state and on the principle that all waters of the state belong to the public and therefore may be allocated by the state in the interests of the general public.

State grants to private users of ground water are limited to from 5 to 20 years. Water supply grants to public utility water companies are also limited to from 5 to 20 years, at which time such grants must be renewed. The Delaware and Raritan Canal is operated by the Division of Water Policy and Supply, of the State Department of Conservation and Economic Development, to deliver to industries and public water supply systems raw water diverted from Delaware River at Raven Rock. The Division is also the state agency responsible for the evaluation of the surface and ground water resources of the state, for the planning and equitable development of these resources, and for the investigation of the future water supply and other water needs of the state. The existing water control and development legislation and policies have been quite effective in providing for the equitable allocation of water and for the maximum conservation of use. The flood control policy of the state is defined by three encroachment laws originally enacted in 1929. The state has no direct control over the development of flood plains outside of the minimum channel required for the safe passage of flood waters. Authority, however, is given the municipalities by the State Municipal Zoning Enabling Law for the incorporation of flood zoning provisions in municipal zoning ordinances. In the matter of flood insurance, it is the contention of the Division of Water Policy and Supply that such insurance should be administered in a manner so as to discourage the unwise development of lowlands subject to frequent flooding.

26. STATEMENT FOR THE COMMONWEALTH OF PENNSYLVANIA. a. A paper entitled "State Laws and Policies Governing the Development of Water Resources in Pennsylvania" was presented by Bernard D. Murphy, Chief Engineer of the Pennsylvania Department of Forests and Waters, and alternate member. Administration and management of water resources is the responsibility of the Water and Power Resources Board, an administrative board of the Department of Forests and Waters. Advisory functions in the Department of Forests and Waters are exercised by the Flood Control Commission. Pollution control is primarily the province of the Department of Health and its administrative arm, the Sanitary Water Board. The Board is not the exclusive enforcing agency. The Pennsylvania Supreme Court in 1951 held that courts are empowered to abate nuisances regardless of the action or inaction of the Sanitary Water Board. The "Mill Dam Act," passed in 1803, authorized the erection of dams upon streams for mills and other works, subject to certain restrictions. Other acts, passed in 1907 and 1913, govern obstructions in navigable and non-navigable water courses within the Commonwealth. The "Water Well Drillers License Act," requiring the licensing of water well drillers was passed in 1956. Companion legislation, designed to give some control over the use of ground water failed of passage. The statutes enacted by the legislature show that the flood problem is well recognized in Pennsylvania. The main statute is the Act of 1936, as amended, which



facilitates the Commonwealth's compliance with the provisions of local cooperation which may be included in the authorizations for Federal projects in Pennsylvania. Under this act all lands, rights, easements, and other acquisition shall be obtained without cost to the United States, and flood control works shall be operated according to rules promulgated by the Secretary of the Army. A flood control commission was created for the purpose of studying, investigating and making recommendations on policies on flood control in June 1957. There is active cooperation with the U. S. Weather Bureau in flood forecasting work and the U. S. Geological Survey in collecting stream gaging data. Pennsylvania is lacking in adequate legislation pertaining to the quantitative use and allocation of its water resources. By the Act of 1919, the Water and Power Resources Board is empowered to allocate surface water to public water supply agencies. By the Act of 1923, the Board is authorized to issue power and supply permits and to make rules and regulations and issue orders necessary to carry out its provisions. The Pymatuning Dam, in northwestern Pennsylvania, is an example of the State's policy regarding development of water resources. Its operation is to provide an increase in dry weather flow and to furnish sufficient water for domestic and industrial use to communities along the Shenango and Beaver Rivers. It also provides recreation, flood control and low flow augmentation for Shenango River. In 1957 the legislature clarified certain provisions of law with respect to a dam to be constructed across the main stem of Delaware River. The Department of Forests and Waters has also under way the preparation of a Model Water Act.

b. Upon completion of his presentation, Mr. Murphy introduced Mr. A. J. Sommerville, Hydraulic Engineer, of the Pennsylvania Department of Forests and Waters, who presented a paper entitled "Flood-Plain Zoning - Planning for the Future." Flood-plain zoning has been recognized as an effective means of reducing loss of life and property due to floods, but action to zone potentially hazardous areas has been slow. There is a real need to promote flood-plain zoning as a sound planning practice and an effective means of flood-damage abatement. The state, in cooperation with the U. S. Geological Survey, has been studying the hydrologic and hydraulic aspects of flood-plain zoning. The study results are intended to be a guide and working manual to those who will be responsible for developing and applying flood-plain zoning. Proper legal authority is necessary for enforcement of zoning ordinances. There is legislation which grants all civil subdivisions the right to exercise zoning powers, and although flood-plain zoning is not mentioned specifically in any of the zoning enabling acts, it is believed that the intent of the Legislature is clear and that it considered flood-plain zoning an appropriate part of any civil subdivision plan where flood hazards exist. It appears that the legal means for implementing flood-plain zoning exist. There is a vital need for an organized program of public education on flood-plain zoning and usage so that the means of zoning can be put to use with the support of an informed public.



27. SUMMARY ON STATE LAWS. a. The Chairman remarked on the similar thinking, in the states' legislation, regarding water resources development and control. All agree on the application of riparian rights blended with the doctrine of reasonability and the necessity for a controlling agency to protect the sanctity of water rights in order to keep those rights in beneficial operation. All agree that private good be subjugated to public good and give recognition to flood damage potential. There is agreement that damages and hazards can be alleviated by flood-plain zoning. The constant references, in all water use law discussion, to what was done as far back as 150 years ago, show the necessity for the development of control, and point up the necessity for comprehensive planning and bringing into the open the best compromise solutions for the public good.

b. Mr. Shanklin of New Jersey expressed the opinion that all available information, both factual and projected, should be published, instead of being filed, so that it could be used by municipalities and states. Colonel Powers indicated that all data of the Corps of Engineers were distributed. Mr. Shanklin maintained that when a project is finished, the information is filed and is almost impossible to get ten or fifteen years later. He felt that even though old, the material could be used despite the changes that may have occurred throughout the years; that such material is better than no information at all, and that reports published prior to 1900 have been invaluable in recent studies. Colonel Powers stated that he would like to have the comprehensive report presented as a living document. It should be based on actual facts plus projections and provide that if, in future years, those projections are found to be incorrect, the report could be adjusted as might be appropriate at that time.

28. COMMENT FOR DELAWARE RIVER BASIN ADVISORY COMMITTEE. Mr. Walter M. Phillips, Executive Secretary of the Delaware River Basin Advisory Committee, referred to the fact that the basin is a single hydrologic unit extending into several governmental jurisdictions and pointed out the problems involved in seeking realistically to adapt water law to hydrologic principles in an interstate basin. He mentioned research in government organization under way at Syracuse University, and said that it might shed some light on the problem. He also announced that the Board of Directors of Delaware River Basin Research, Incorporated, is seeking to finance a small research project on the legal aspects of various devices for reserving land for future reservoir use.

29. COMMENTS FOR THE INTERSTATE COMMISSION ON THE DELAWARE RIVER BASIN. Mr. James H. Allen, Executive Secretary of INCODEL, indicated that the Commission is anxious to see a comprehensive plan developed for the Delaware basin and to see the essential features of that plan carried out. INCODEL is cooperating fully with Federal and state agencies by making available to them any material it has.

30. GENERAL DISCUSSION ON SUGGESTIONS OF TOPICS FOR CONSIDERATION AT NEXT MEETING. Colonel Powers announced that 20-21 February and 27-28 February 1958 were being considered as dates for the fourth meeting to be held in Philadelphia, and requested the Committee members to advise him as to which pair of dates they preferred after checking their calendars. The Chairman suggested that for the next meeting, the theme be planning factors and status of plan development, and he offered to have the Valley Report Group of the Corps' District Office make a presentation on the following topics:

- a. Summary of the data on magnitude of flood damages.
- b. Order of magnitude of projected water needs.
- c. Basin sub-area contributions to flood flows.
- d. Water supply potentials of each of the sub-areas.
- e. Storage possibilities in basin sub-areas.

Working groups were invited to request time for presentation of papers or for discussion.

31. The meeting was adjourned at 12:50 P.M.



W. F. POWERS  
Colonel, CE  
Chairman

APPENDIXES:

- A. Economic Appraisal of Water Resources Development.
- B. Report on Status of Work by C.of E.-SCS Joint Work Group.
- C. Statement of Policy on Recreational Use of Reservoirs  
Built Under Public Law No. 566.

MINUTES OF FOURTH MEETING  
OF THE  
DELAWARE BASIN SURVEY COORDINATING COMMITTEE  
HELD 27-28 FEBRUARY 1958  
AT PHILADELPHIA, PA.

1. OPENING REMARKS. The Committee was convened in the Edison Building Auditorium, Philadelphia, Pa., at 1:25 P.M., 27 February 1958, by Colonel W. F. Powers, Chairman. The Chairman expressed his appreciation to Mr. K. M. Irwin, Vice-President for Engineering, Mr. Richard A. Lane, Assistant to Chief of Mechanical Engineering Department, and Mr. Robert Burns, Building Superintendent, all of the Philadelphia Electric Company, for making their facilities available and for their fine arrangements for the meeting.

2. INTRODUCTIONS. a. Colonel Powers introduced Mr. Richard A. Hertzler, Chief, Office of Civil Functions, Office of the Assistant Secretary of the Army; Mr. Frank L. Weaver, Federal Power Commission, Washington, D. C.; and Mr. E. W. Landenberger, a representative from the Office of the Chief of Engineers.

b. The Chairman then introduced Mr. Ronald B. Peterson, Director of Industrial Development, Department of Commerce, State of New York, who was recently appointed by Governor Harriman to replace Dr. Thorndike Saville as New York State's member of the Coordinating Committee. Mr. Peterson had previously served as the alternate for the State of New York.

c. The following members and alternates were present:

Mr. Richard Ackroyd, Dept. of Commerce, for Mr. S. L. Taylor  
Mr. Samuel S. Baxter, City of Philadelphia  
Mr. B. Budd Chavooshian, State of New Jersey (Part Time), for Mr. McLean  
Mr. Arthur C. Ford, City of New York  
Mr. D. R. Gascoyne, Dept. of the Interior  
Dr. A. Joel Kaplovsky, State of Delaware  
Mr. Sylvan C. Martin, Dept. of Health, Education & Welfare  
Mr. Joseph E. McLean, State of New Jersey (Part Time)  
Mr. Ronald B. Peterson, State of New York  
Colonel W. F. Powers, Department of Army, Chairman  
Mr. A. J. Sommerville, Commonwealth of Pennsylvania, for Mr. Maurice K. Goddard  
Mr. John H. Spellman, Federal Power Commission  
Mr. Alvin C. Watson, Dept. of Agriculture

d. The Department of Labor was the only agency with membership on the Committee that was not represented at the meeting. The names of those who registered and attended the meeting are contained in Appendix A hereto.

\* See minutes of next meeting for corrections.

3. MINUTES OF PREVIOUS MEETING. a. The following modifications were requested in the minutes of the third meeting held at Wilmington, Delaware, on 14-15 November 1957.

(1) Mr. Lester M. Klashman, Public Health Service, requested changes in paragraph 21, page 12, that involved deletion of the last sentence and the addition of the following: "Mr. Watson's remarks, including five items of policy regarding this matter, are contained in Appendix C. In reply to a question raised by Mr. Martin with respect to policy item 4 appearing on page 3 of Appendix C, to the effect that in flood prevention structures future facilities for recreation can be built in, Mr. Watson stated that local interests would pay all of the costs of these future facilities. Mr. Martin also raised a question on facilities to meet future water supply needs, to which Mr. Watson replied that the Department of Agriculture will point out the need for such facilities if it exists. Mr. Martin asked whether the Department of Agriculture, because of the conflict between water supply and recreational uses, would adopt rules and regulations on water use. Mr. Watson replied that the conflict must be settled locally and therefore his Department did not contemplate adopting any rules and regulations. Mr. Martin observed that the Coordinating Committee in considering the projects would have to review the impact of the various interests on each other."

(2) Mr. Vincent G. Terenzio, New York City, requested that the word "four" on line 12 of paragraph 19 on page 11 be changed to "twenty-four".

b. The minutes were approved, subject to the above modification.

c. The Chairman approved a request by Mr. John H. Spellman, in which Mr. Sylvan C. Martin concurred, that a full attendance list be published with the minutes of all future meetings.

4. REPORT ON THE DEFINITION OF POLLUTION. Following a discussion at the August 1957 meeting of the Committee, the Chairman appointed a subcommittee to report on the definition of "pollution" for use in the Delaware River Basin Survey report. The report of the subcommittee was presented by Mr. Sylvan C. Martin and is attached hereto as Appendix B. The report was accepted without discussion and the Chairman dissolved the subcommittee.

5. STATUS REPORT - DEPARTMENT OF AGRICULTURE. a. Mr. Alvin C. Watson presented the several individuals who are participating in his Department's effort in the survey and then presented his statement on the status of work on the report on land use and management, and irrigation; various parts of which are being prepared by the Agricultural Research Service, the Forest Service and the Soil Conservation Service.



He indicated that the first draft of the report on land use and management, soil cover and forestry, is scheduled for completion by 15 September 1958 and the final draft by 31 December 1958. The target date for the initial draft on irrigation and rural water use is 15 September 1958 and that for the final draft is 31 January 1959. The portion of the report dealing with farming in the basin has been drafted and is ready for submission to the District Engineer. Based on the present status of and progress on the work Mr. Watson concluded that the due dates for the final drafts would be met. The full statement by Mr. Watson is Appendix C hereto.

b. Comment. In his presentation, Mr. Watson indicated that the work of the agencies in his Department was on schedule. The Chairman expressed his pleasure in noting this point and remarked that adherence to schedules by each participating agency was necessary in order to have the entire report completed by the projected date of September 1959. Colonel Powers requested that in the event any agency becomes aware of problems which would cause it to miss its target day, such instances be brought to his attention at the earliest possible moment so that any necessary rescheduling could be made.

6. STATUS REPORT - CORPS OF ENGINEERS. a. Mr. Russell Morgan, Chief of the Valley Report Group, presented the report on the status of work being performed by the Corps of Engineers. His report is Appendix D hereto. Among other things, Mr. Morgan reported on a meeting of the District Engineer's staff and representatives of the Office of the Chief of Engineers and of the Division Engineer at which the planning procedures being followed in arriving at the comprehensive plan for the basin were discussed and reviewed in detail.

b. Discussion. With respect to the review of planning procedures made by the Corps' representatives, Colonel Powers remarked that it appeared that a suitable procedure is being followed for formulating a basin development plan. Mr. Ford inquired whether in the formulation of the comprehensive plan it was contemplated to set up priorities for water uses. Colonel Powers indicated that for the program as a whole, this is impossible to do; but for any specific project or specific sub-basin, it will be necessary to indicate the specific purposes for which storage is being provided on the basis of present and immediately foreseeable needs. Mr. Shanklin inquired whether the Corps would be interested in receiving from the States indications of priorities of uses for which the over-all plan should provide. Colonel Powers indicated that he would hope to avoid the setting of use priorities for the over-all plan. Mr. Baxter inquired whether the non-setting of use priorities would set aside the establishment of relative values of water use, to which Colonel Powers replied in the negative and indicated that relative values will be of importance in project formulation.

7. STATUS REPORT - DEPARTMENT OF THE INTERIOR. a. Mr. D. R. Gascoyne reported on the status of the studies being made by the Geological Survey, the Fish and Wildlife Service and the National Park Service. The report on ground water by the Geological Survey is to be completed in July 1958. It is expected that drafts of reports on the fish and wildlife studies will be completed over the period 1 May 1958 to 1 February 1959. The studies of the National Park Service are progressing on schedule and it is expected that a draft of the section of the Park Service's report dealing with recreation will be available for distribution in March 1958. The full report made by Mr. Gascoyne is Appendix E hereto.

b. Discussion. In that part of his report pertaining to the activity of the Fish & Wildlife Service, Mr. Gascoyne remarked that for the purposes of this survey, the Service had divided the Delaware basin into 14 areas or sub-basins and had assigned a biologist to each sub-basin. Mr. Martin inquired whether these biologists were studying the flora and fauna in the stream beds. Mr. Gascoyne replied that they were not; that the Service did not have time for any original type work and, therefore, had to depend a great deal upon the state people.

8. STATUS REPORT - FEDERAL POWER COMMISSION. a. Mr. John H. Spellman reported on a meeting which he and Colonel Powers attended, of the Pennsylvania, New Jersey and Maryland Interconnection Coordinating Committee composed of representatives of the electric utility companies operating in the basin area. Invitations to the two Federal agency representatives to attend the utility company meeting was extended to them by Mr. K. M. Irwin, Vice-President of Philadelphia Electric Company, who felt it was the appropriate time for the Corps of Engineers and Federal Power Commission representatives and the power company committee to get together to discuss the various aspects of power studies in the Delaware basin. At the meeting, Colonel Powers outlined for the benefit of the Interconnection Committee, the purposes of the comprehensive survey and covered the current reservoir site studies. Mr. Spellman added a brief description of the general power supply areas that were being considered for marketing purposes, and discussed briefly pumped storage and other facilities that might be incorporated into this comprehensive plan. Mr. Spellman expressed the opinion that it was a worthwhile meeting, and that the utility representatives appeared to be very much interested in and appreciative of the briefing the Federal representatives gave them.

b. Mr. Spellman then described briefly the activity of the Commission staff in the comprehensive survey and indicated that while nothing concrete had been developed for specific sites, the staff would develop specific data in the near future. Meanwhile the Commission staff has continued to compile data for an interim report which summarizes the general data developed to date. This interim report, prepared by Mr. Lazar B. Woll of the Commission's New York

staff, was read by Mr. Spellman, and it is Appendix F hereto. No questions were raised and there was no discussion relative to the report by Mr. Spellman.

9. DISCUSSION OF A BARRIER IN THE DELAWARE ESTUARY. Colonel Powers reviewed the informal discussion of a barrier in the Delaware estuary that the Committee had in its work session on 27 February in order to place the following results of that discussion into the record of this meeting:

Brigadier General Norman M. Lack, (Retired), the representative of the Governor of Delaware on the Delaware River Basin Advisory Committee, attended the work session as a guest and at that time described the proposed barrier project and the advantages thereof in general terms. There are many physical aspects which need to be considered, and advantages and disadvantages which need to be identified and evaluated in the study of a project of such enormous proportions. Colonel Powers expressed the opinion that a thorough study of such a project in all its engineering and economic phases would require in excess of a year and perhaps two years, and that it could, perhaps, cost as much as two million dollars. Furthermore, if undertaken at this time by the same agencies, with the staffs presently engaged in the comprehensive survey, it would delay the completion of the comprehensive report as it is now visualized. The Corps is attempting to complete the comprehensive report in September 1959, and it is the Chairman's and the Committee's views that the completion date should not be deferred unnecessarily; nor should the concept of a barrier be regarded lightly. Before any governmental agency undertakes a survey scope study of such a large project, it is customary to make a preliminary study or examination of the proposal. This can usually be done expeditiously and relatively inexpensively and in such case the groups now working on the comprehensive report could probably accomplish the added work without unduly delaying the completion of the comprehensive report. It was the consensus of opinion of the Committee that Colonel Powers, as District Engineer, should present to his higher headquarters the fact that a request for a study of a barrier in the Delaware estuary had been received by the Committee, and that he should request funds for making a preliminary examination of the proposal and include the results thereof in the comprehensive report. In the event it is determined in Washington that an examination into the barrier proposal should not be undertaken at this time, a short summarization of the advantages and disadvantages of a barrier in the estuary would be presented in the comprehensive report together with a recommendation regarding future action to be taken with respect to further investigations thereof. Should it be determined to proceed with a preliminary examination, Colonel Powers expressed the opinion that in about four or five months after funds become available it may be possible to report whether a study of survey scope should be undertaken.



10. STATUS REPORT - DEPARTMENT OF COMMERCE. a. Mr. Richard Ackroyd presented a short summary report on the studies to date being made by the bureaus of the Department of Commerce. In his presentation he indicated that the Office of Business Economics was drafting its preliminary report but gave no schedule for completion of work by that agency. He also reported that the Weather Bureau had completed certain items of work. The full summary is Appendix G hereto.

b. Comment. With respect to the work completed by the Weather Bureau, Mr. Shanklin inquired whether reports on that work could be obtained directly from the Bureau or whether they were available from the District Engineer's office. Colonel Powers indicated that there was no objection to getting such reports directly from the Bureau.

11. STATUS REPORT - DEPARTMENT OF HEALTH, EDUCATION & WELFARE. a. Mr. Sylvan C. Martin presented a report on the status of studies being made by the Public Health Service, stating that the report on Municipal and Industrial Water Use, in final form, is scheduled for submission to the Corps of Engineers on or before 20 May 1958. The initial draft of certain portions of the water quality report is being revised and it is planned to send the revised draft to the Water Quality Work Group in mid-April for consideration. Additional portions of the report dealing with water quality in specific areas, including the stretch from Port Jervis to Trenton, will be completed in April and May. Another portion dealing with conditions in the tidal portion of the Delaware will be started this summer. The water quality aspects north of Port Jervis will be included in the final report, for which no scheduled date for completion was given. Mr. Martin's full report is Appendix H hereto.

b. Comment. Mr. Shanklin inquired as to what action had been taken on the comments made by the two Work Groups which were designated to review the drafts of the reports on Municipal and Industrial Water Use and Water Quality, which drafts were distributed by the PHS in August 1957. Mr. Martin replied that revisions were made to the reports in accordance with the comments, and the the revised reports would be submitted to the District Engineer, after they were reviewed by the Work Groups.

12. STATUS REPORT - C. OF E. - SCS JOINT WORK GROUP ON UPSTREAM AUXILIARY RESERVOIR PLANNING. a. Mr. Glenn W. Grubb presented the report for the Joint Work Group, attached hereto as Appendix I. He also stated that the Department of Agriculture is planning for a field crew to get damage information for use in the study of the 36 dam sites selected at random from the list of 338 sites compiled by the Work Group. That information will be used in the economic justification of projects.



b. Discussion. A question was raised by Mr. Ackroyd regarding the difference between the list of 185 sites compiled by the Corps of Engineers which was announced at the work session during the morning of 27 February and the 36 sites selected for detailed study by the Joint Work Group. Mr. Grubb indicated that the sites selected by the Joint Work Group were located on tributaries and in headwater areas, and that the drainage areas above such sites ranged from one square mile up to some 20 square miles, most of the drainage areas being from 5 to 15 square miles in extent. Mr. Shanklin inquired whether information on the upstream auxiliary reservoir projects would be submitted to the states for review and comment, and Mr. Grubb indicated that this would be done. Mr. Morgan offered further remarks relative to the points raised by Messrs. Ackroyd and Shanklin by stating that the list of 185 sites is an inventory of all sites known by the Valley Report Group to have been studied or considered in the past by various interests, plus those found during the course of the current survey. Of that inventory of 185 sites, 65 were selected for preliminary study and evaluation. The 338 sites of which Mr. Grubb spoke are upstream dam sites that have been identified by the Joint Work Group and of these sites 36 have been selected for detailed study. The upstream projects will be covered in an appendix to the report which will be prepared by the Joint Work Group and distributed for comment.

c. Mr. Larson commented further in reply to Mr. Shanklin's question to the effect that a determination as to which specific sites among the 338 should be developed at an early date had not yet been made; that in the small reservoir program it is usually up to the local people to make such selections, after they determine what it is that they need, particularly, if the projects are to be accomplished under Public Law 566. This puts the Joint Work Group in the position of needing identifications of potential sites for purposes of the report so that a sampling of them can be studied in detail to determine design criteria, costs and effects; thus 36 sites were selected initially for this purpose, and it may be found desirable to modify procedures for working on the remainder of the sites. The Joint Work Group also recognizes that in formulation of its report it is necessary to present an estimate of the effects that the execution of an upstream auxiliary reservoir program might eventually have on the total Delaware problem. Mr. Larson expressed apprehension about pinpointing a certain number of sites as those which should be developed by local interests for their purposes because it would then appear that the authors of the report were placing themselves in a dictatorial position. Mr. Shanklin agreed that it would be unwise to pinpoint all these sites and to make a general release of information regarding the criteria developed in the studies of the upstream auxiliary reservoirs, but he felt that there was a need for the States to have the criteria as a guide for use in reviewing the final report. The Chairman then

called attention to the fact that the Federal agencies were requested to deal directly with their counterparts in the respective State governments so that there would be full discussion of the procedures and plans, and added that if this arrangement was not satisfactory, the representatives of the states should contact the Federal agencies concerned to get the information needed in order to comment properly on the report. Mr. Larson indicated that the Joint Work Group would be in a position to furnish such information in about two months

13. COMMENTS BY THE CHAIRMAN. a. Colonel Powers summarized his views of the task facing him as the District Engineer responsible for the report. Since he assumed that assignment he has tried assiduously to prepare himself to understand the various interests involved in this survey and the people engaged therein. This he has found most interesting. Generally, in respect of progress, he felt that the status was what it should be; however, the next six months are expected to be more crucial, for it will be in this period that demands and interests will need to be reconciled with water availability and practicalities in order to prepare an acceptable and feasible engineering plan for water use and water resource development without regard to political boundaries. Once this is done and agreed upon, problems arising by reason of state, county and city lines will be considered and solved.

b. With reference to the several requests voiced during this meeting and on prior occasions, Colonel Powers stated that his office had many papers which the various members and their related agencies may need or find useful, but it would be impossible for him to reproduce and distribute them in the quantities required to cover all possible or probable areas of interest; therefore, he proposed to set up in his District Office a special room to which individuals engaged in the survey may come at their convenience to examine the available data.

c. The meeting was recessed until the morning of the following day.

14. REMARKS FOR THE STATE OF DELAWARE. a. Dr. A. Joel Kaplovsky presented a paper prepared by the Delaware Coordinating Committee on the progress of the State and County agencies participating in the preparation of the State's report for the comprehensive survey. The paper presented is Appendix J hereto

b. Discussion. Colonel Powers remarked that the need is evident within each state to do what the State of Delaware has embarked to do - to review and analyze the water needs situation in order to intelligently review, comment upon and discuss the comprehensive report in its entirety as well as in sections as they become available, for only then would those people who will utilize the water be able to decide intelligently whether they want to go along with the report.

c. With respect to a statement in Dr. Kaplovsky's presentation to the effect that some untapped aquifers have shown evidence of salinity intrusion, the Chairman suggested that perhaps the various terms used in past discussion of the subject of salinity intrusion might have different meanings to different individuals. Mr. Ferguson of the U. S. Geological Survey agreed that this was entirely possible because the principles causing sea water intrusion and diffusion were not yet fully known. Mr. Martin asked if determinations of chemical water quality were made during the studies of sea water intrusion. Mr. Ferguson replied that many such analyses were made; that this was a vital part of such investigations. Mr. Ferguson was asked by Colonel Powers whether the term "sea water intrusion" commonly included natural geologic processes wherein ocean water moved into fresh water aquifers prior to utilization. He replied in the negative and explained that the term usually indicated the "salting" of fresh water aquifers having current or potential utility and was caused by man-made changes, such as a lowering of fresh water tables. He further stated that study of sea water intrusion was not being made currently for the entire coastline but was confined to specific problem areas.

d. The Chairman broadened the discussion of ground water by commenting that he was aware that a complete inventory of the ground water resources of State of New Jersey is extremely difficult to make and may be completely accurate only after a study period as long as ten years. The USGS has made a study and will furnish a report on this subject to be used in the comprehensive report. Based on casual observations during the course of its study of water in New Jersey, the USGS has noted a very great increase in the demands of agriculture for water to meet irrigation needs. Mr. Shanklin made the point that this was a short term demand, for irrigation was practiced for only a part of the year and not for fifty-two weeks.

e. Mr. Martin raised the question as to how much of the irrigation water use was going to be consumptive and how much non-consumptive. Also, with respect to salt water intrusion, he inquired whether information was being collected as to location and amounts of intrusion, the kinds of salinity in the intrusions and the amounts. Mr. Watson replied that generally sprinkler application as practiced in the basin puts irrigation water use in the category of consumptive use. Mr. Larson commented that the SCS is trying to determine the areas where irrigation is practical but not now practiced, the extent of those areas and whether water is accessible to them. These facts are difficult to ascertain. Whether irrigation practices will increase or decrease is most difficult to predict due to urban and industrial expansion possibilities. Flat lands ideal for irrigation practice are taken up for industrial areas; the trend for irrigation may be decreasing instead of increasing. A joint study of this matter by the SCS and ARS is underway.



f. With respect to the salinity question, Mr. Ferguson stated that quality measurement is one of the most important tools in studying salt water intrusion. The Geological Survey has no money for salt water intrusion investigations. Mr. Meredith Johnson commented on the salinity problem in South Jersey and pointed out that rainfall on the surface has flushed out the chloride content of the soils and it is now an exceptional thing to find chloride content in surface waters. With regard to salt water intrusion he referred to a rock formation which crosses the Delaware and extends upstreamward from a point about one mile below Riverside in New Jersey and which, because it comes to within 18 feet of the surface, prevents major salt water infiltration to the aquifers underlying it. He was prompted to make this observation because of a proposal to place a dam at the north end of Petty's Island, and if this were done, it would protect a relatively small area between such a dam and the rock formation. In the lower part of the state, the danger from salt water infiltration becomes very great if there is considerable pumpage near Delaware Bay.

15. REMARKS FOR THE STATE OF NEW YORK. a. Mr. Ronald B. Peterson stated that New York State is currently and actively concerned with the use and conservation of its water resources for the future. Legislation is currently pending which would establish what would in effect be an overall water policy agency for the state to coordinate the activities of the score or more of state agencies presently concerned with various aspects of water use and conservation.

b. A new and growing need for water is becoming more and more important. Each year the amount of water consumed for agricultural irrigation purposes is approximately doubled. A consumptive use of this nature may require some basic changes in the State's water laws which up to the present have been based on riparian principles. Insofar as the Delaware basin area of the State is concerned, the State's principal concern must be the water supply developments which have taken place here to care for the needs of the City of New York. New York City has, during the past half century, invested approximately \$100. for each individual living in the City to provide an adequate water supply for all needs. Protection of this supply including structures erected within the Delaware basin is a major concern and responsibility of the State. Coincident with this interest is the State's responsibilities for assuring that the people and communities of the Delaware basin area of the State are not unduly hampered insofar as economic or industrial development for the future is concerned. Mr. Peterson expressed confidence that all of these interests and responsibilities can be met within a framework of cooperation with its sister states who also have a stake in the Delaware Basin.

c. In this respect, Mr. Peterson was most sympathetic to the needs of the State of Delaware and its request that this comprehensive survey include studies of possible methods whereby the Delaware River might be used as a more adequate source of water supply for the people of that state, and he concurred with Delaware's request in this respect.



16. REMARKS FOR THE COMMONWEALTH OF PENNSYLVANIA. Mr. A. J. Sommerville presented a report on various water control projects underway by the Commonwealth in the Delaware basin area. The stream clearance work necessitated by floods caused by hurricane DIANE and storms thereafter is almost complete. Although most of this work is not of a permanent nature, it was, with a few exceptions, effective during the 20 December 1957 storm. A survey to define limits of land acquisition in the Wallpack Bend area will be completed in May. Designs for flood protection projects for Hawley, Weissport and White Mills are awaiting local approval. Preliminary designs for protection of Stroudsburg and East Stroudsburg are completed but this project is delayed due to the inability of the local interests to furnish the required cooperation. A consulting firm has been engaged to make a study of the Brandywine Valley. Mr. Sommerville's report is Appendix K hereto.

17. REMARKS FOR THE CITY OF NEW YORK. a. Mr. Arthur C. Ford delivered a statement covering the cooperation of the City of New York with the Federal agencies participating in this survey and the City's need for its water supply developments in the upper portion of the Delaware watershed. The full text of Mr. Ford's statement is Appendix L hereto.

b. Comment. Referring to Mr. Ford's remarks regarding his City's cooperation in the survey effort, the Chairman commented to the effect that the City's participation in the deliberations of the Coordinating Committee is essential if the representatives for New York City in making their estimate of requirements from the Delaware River water supply are to make such estimates with a full realization of the methods of arriving at the entire water demands placed on the Delaware basin.

18. REMARKS FOR THE STATE OF NEW JERSEY. a. Mr. George R. Shanklin presented a statement on the water resource planning being done by the State of New Jersey and on the pending legislation related to ground water use. The full text of Mr. Shanklin's statement is Appendix M hereto.

b. Comment. With respect to the planning by New Jersey for reservoirs in the Raritan Valley, Dr. Kaplovsky inquired whether the planned minimum flow was for resale or to supplement diversions created by a trunk sewer system. Mr. Shanklin replied that both purposes would be served; 90 mgd on the lower river for riparian use and 60 mgd for sale. The 90 mgd will supplement diversions created by the new Middlesex County trunk sewer. Mr. Shanklin indicated that no violations of the riparian law are involved in the operation of that trunk sewer; however, difficulties may develop in maintaining the specified 90 mgd due to the increasing irrigation use on the Upper Millstone River; the control of such use is proposed under the new legislation for private use of surface water.

c. Mr. Shanklin continued the discussion by stating that the planning envisions much re-use of Raritan River water developed by Spruce Run and other on-river flow regulating reservoirs. He noted that the U. S. Public Health Service report on water use for the Delaware Basin and Service Areas presents interesting data on the subject of re-use, indicating that much of the industrial and public water supply in the New Jersey northern metropolitan area, probably 90% or more, from both surface and sub-surface sources is used only once, being delivered in pipelines and discharged into sewers which empty into the ocean; whereas, most of such supplies in the Delaware basin are re-used several times by being treated and returned to the river. Mr. Morgan, referring to Mr. Shanklin's mention of re-use, indicated that there was not much information on the subject in this particular area, and asked whether New Jersey planned to make a field survey of the potential re-use possibilities and if such a survey were undertaken, when would the information be available. Mr. Shanklin replied that he had asked the U. S. Public Health Service to consider water re-use in his comment on the Service's preliminary report. The State will need to make some similar survey or an estimate for its Raritan River program; the County Planning Boards have been requested to estimate potential re-use by reaches. Mr. Shanklin remarked that he did not know what was the best approach for determining re-use, but believed that for the Delaware study, the information will need to be developed by the regions adopted for the study.

19. REMARKS FOR THE CITY OF PHILADELPHIA. a. Mr. Samuel S. Baxter opened his remarks with the observation that when a man works for a large city he is faced with the requirement of being provincial in order to look after the interests of his own city, and at the same time being broad-minded enough to see the whole picture. He noted that there were discussions of small dam sites and major dam sites, and the distribution of these, but as yet he had not seen any tabulations dealing with the domestic and industrial water needs for the large metropolitan areas. It is necessary to have a real good look at such tabulations and the indications as to the source of water to meet these needs. These latter must be satisfied before there can be talk about recreational and other incidental uses. In Mr. Baxter's opinion, the presentation made for the City of New York left the impression that there is no conflict, whereas he feels that there is a conflict of interests as one looks into the overall problem. It will be necessary to cooperate and compromise in order to work out these conflicts, if there is to be growth. A point may be reached where limitations of growth will depend on the amount and distribution of the available water. It has been found in Philadelphia that the releases from New York City's Delaware River reservoirs provided more water in the past drought year than could have been expected under natural flow conditions. If a severe drought were to occur in 1975, it is highly probable that there will not be as much water for release and Philadelphia might be hurt. As for some of the things the City is

doing, the construction of improvements for the filter plant at Torresdale is 60% complete and at Queen Lane the work is going on steadily. The improvement of both will be completed by the time the comprehensive report is out.

b. Discussion. Mr. Ford stated that he did not intend to leave the impression that there were no problems or differences to be resolved, but that by intelligently working together there is no reason why this group could not resolve these differences at a practical level. He stressed that there was no point in working to a final plan unless that plan produces a state of relationship under which all concerned could live in harmony; there would be no sense launching into a situation where there is a prolonged state of dispute and differences. Mr. Ford noted that the water resources are limited to a certain extent, however, the amount of water available and the water needs are known, and reasonable people will come to terms on a plan for its use. In reply to Mr. Ford, Mr. Baxter indicated that there were no personal differences.

20. DESIGN CRITERIA FOR UPSTREAM RESERVOIRS AS AGREED UPON BY THE C. OF E. - SCS JOINT WORK GROUP. a. Mr. McNamara, Chief, Design & Estimate Unit of the Valley Report Group, presented information on the structural design of dams at upstream auxiliary reservoir sites as developed by the Joint Work Group of the Corps of Engineers and the Soil Conservation Service. This information appears in Appendix N hereof.

b. Comment. Mr. Shanklin noted that the criteria did not conform with the provisions of the State of New Jersey for grass spillways; also that the 24" pipe for the main spillway is inadequate, that it should be 48" and not less than 36" in order to pass debris. He indicated that he was furnishing the Joint Work Group a copy of the State's requirements for information and comment. Mr. Underhill inquired whether any thought had been given to ownership of these upstream auxiliary reservoirs and whether some agency would have control of them. The Chairman indicated that Mr. Larson covered this matter on the preceding day, and that at the present time, for the purposes of the survey, considerations do not go beyond a physical plan.

21. CONTRIBUTIONS OF BASIN SUB-AREAS TO FLOOD FLOWS. a. Mr. Marshall R. Ishisch, Chief, Hydrology Unit of the Valley Report Group, presented a report on the contribution of basin sub-areas to floods on the Delaware River, and demonstrated graphically the effect that each of the 27 component sub-areas had on the flow at Trenton in the August 1955 flood. This report is Appendix O hereto.

b. Comment. Colonel Powers commented that this type of analysis will need to be made for each of the problem areas.

22. SUMMARY OF DATA ON THE MAGNITUDE OF FLOOD DAMAGES. Mr. David E. Donley, Chief, Plans & Reports Unit of the Valley Report Group, presented a summary of data on the magnitude of flood damages. There was no comment on or discussion of the subject. The full text of Mr. Donley's presentation is Appendix P hereto.

23. ORDER OF MAGNITUDE OF PROJECTED WATER NEEDS. a. The presentation on this subject was made by Mr. Russell Morgan. He described the basis for the projections, and gave preliminary projections for domestic and industrial water consumption for the years 1965, 1980 and 2010 by sub-areas. Mr. Morgan's paper is Appendix Q hereto.

b. Comments. There was a request for a summation of the projected water needs, to which Mr. Morgan replied that no total was made because it might give an erroneous picture, and pointed out that these are gross needs without consideration of re-use factors. Mr. Bower quoted 80% as the re-use for the Delaware-Hudson region and suggested that 100% be applied to the Delaware basin. He indicated that the staff of the Delaware River Basin Advisory Committee had need for the total projected demands for the water service area, and suggested that the sub-area demands be totalled and a re-use factor be applied. Mr. Morgan implied that this could be done after further study and commented that a re-use factor of 3-1/2 for the Ohio River had come to his notice recently. Mr. Shanklin inquired whether it would be possible to obtain information on the current projections even though of a preliminary nature so that the States could use them as a basis for answering some of the questions brought up. Colonel Powers indicated that the back-up studies and other information was available for use in preliminary studies by cooperating agencies but warned that such information should not be used for "official thinking".

Mr. Ross requested an indication as to when, on the basis of these projections, the demand would exceed the supply from the Delaware River. Mr. Morgan stated that such an estimate had not been made, but that the next paper to be presented would deal with surface water supply potentials of the basin sub-areas.

Mr. Martin raised the point of water use for cooling purposes in power plants and inquired as to when information on the demand for this purpose would be available, and what would be the impact on this demand by atomic power plants. Mr. Morgan replied that an estimate of demand for cooling water had not yet been made; and as for cooling water for atomic power plants, the present indications are that the amount of water required would be about the same as for fossil fuel plants.



24. WATER SUPPLY POTENTIALS OF BASIN SUB-AREAS. Mr. Russell Morgan also presented a report on the water supply potentials of the basin sub-areas. There was no discussion of this subject. The full text of this presentation is Appendix R hereof.

25. STORAGE POSSIBILITIES IN THE BASIN SUB-AREA. a. The presentation on this subject was made by Mr. C. C. McNamara. He showed locations of sites which are being studied as well as an inventory of 185 sites which were considered at various times in the past. The full text of this presentation is Appendix S hereof.

b. Comments. Colonel Powers announced that he would be glad to hear of any additional sites, and indicated that the lists of sites and the maps referred to by Mr. McNamara would be sent to the Coordinating Committee, INCODEL and the Delaware River Basin Advisory Committee.

26. REMARKS FOR DELAWARE RIVER BASIN ADVISORY COMMITTEE. Mr. W. Brinton Whittall, representing the Advisory Committee in place of Mr. Walter Phillips, had no statement to make at this time.

27. REMARKS FOR THE INTERSTATE COMMISSION ON THE DELAWARE RIVER BASIN. Mr. James H. Allen, representing Mr. Francis Pitkin, the Chairman of INCODEL, complimented the Corps and other agencies on the manner in which they are working together. INCODEL has been cooperating fully with all these agencies, and at the present time is centering most of its attention in cooperating with the Delaware Water Pollution Control Commission and the U.S. Public Health Service in attempting to appraise the comparable values of upstream releases on water pollution in the estuary. Mr. Allen stated that he could not yet indicate what success the group will have. He extended an invitation to all to attend INCODEL's annual meeting at Atlantic City on 2, 3, and 4 October.

28. SUGGESTIONS FOR THE NEXT MEETING. The Chairman indicated that the date for the next meeting would be announced as soon as it could be set; probably at the end of May or early June. Consideration is being given to the possibility of having the next meeting in the upper part of the basin, possibly Honesdale, Pa. Colonel Powers requested the members of the Coordinating Committee to consider the status of their respective programs and advise him within the next two weeks of such papers they would like to present at the next meeting.

29. ADJOURNMENT. The meeting was adjourned at 3:30 P.M. on 28 February.



W. F. POWERS  
Colonel, CE  
Chairman

\* MINUTES OF FIFTH MEETING  
OF THE  
DELAWARE BASIN SURVEY COORDINATING COMMITTEE  
HELD 26-27 JUNE 1958  
AT HONESDALE, PENNA.

1. OPENING REMARKS. Committee was convened in the Honesdale High School Auditorium, Honesdale, Pa., at 1:15 P.M., 26 June 1958 by Colonel W. F. Powers, Chairman. The Chairman expressed his appreciation to Mr. Brock, Superintendent of Schools, Wayne County, and Mr. Wm. T. McGinnis, Principal of the Honesdale High School for making facilities available for the meeting. He also thanked Mr. Wilber A. Blain, Area Engineer and Mr. J. M. Anderson of the Area Office for making arrangements for the meeting.

2. INTRODUCTIONS. a. Colonel Powers introduced Messrs. H. C. C. Weinkauff and E. W. Landenberger of the Office of Chief of Engineers and Messrs. James R. Johnston, and Burnham H. Dodge, of the North Atlantic Division Office.

b. The Chairman then introduced the members and alternates of the Coordinating Committee, who were as follows:

Mr. Richard Ackroyd, Dept. of Commerce, for Mr. S. L. Taylor  
Mr. Lester M. Klashman, Dept. of Health, for Mr. S. C. Martin  
Mr. A. C. Watson, Dept. of Agriculture  
Mr. D. R. Gascoyne, Dept. of the Interior  
Mr. J. H. Spellman, Federal Power Commission  
Mr. Patrick Connell, Dept. of Labor, for Mr. J. F. Foy  
Dr. A. Joel Kaplovsky, State of Delaware, for Mr. R. A. Haber  
Mr. B. Budd Chavooshian, State of New Jersey, for Mr. J. E. McLean  
Mr. R. B. Peterson, State of New York  
Mr. M. K. Goddard, State of Pennsylvania  
Mr. Arthur C. Ford, City of New York  
Mr. Samuel S. Baxter, City of Philadelphia

c. The members introduced the various representatives from their agencies. The names of the 125 persons who registered and attended the meeting are listed in Appendix A hereto.

3. MINUTES OF PREVIOUS MEETING. a. The following modification was requested in the minutes of the fourth meeting held in Philadelphia, Pa., on 27-28 February 1958:

In Appendix R, paragraph 3a, the last sentence reads: "Period used was 1923-1943 inclusive." It should read: "Period used was 1923-1954 inclusive."

\* See minutes of next meeting for corrections.

b. The minutes were approved subject to the above modification.

4. REPORT RELATIVE TO EVALUATING AND PROJECTING THE EFFECTS OF POLLUTION IN THE TIDAL BASIN. a. Mr. A. N. Diachishin, a consultant of the Public Health Service, reported on the methods to be used in evaluating and projecting the effects of pollution in the tidal portion of the Delaware River below Trenton, N.J. The methodology is essentially a statistical application of a group of equations representing a harmonic series which will be analyzed to determine the various complex components of water quality. A copy of this report is attached as Appendix B hereto.

b. In response to a question by Dr. Kaplovsky, Mr. Diachishin stated that data on the model study work by the Waterways Experiment Station, at Vicksburg, Mississippi, had been incorporated into this report as far as possible, but there were limitations on the use of those data.

c. In response to a question by Mr. Gascoyne as to what provisions were made in the analysis procedure to compensate for wind tides, Mr. Diachishin explained that the only manner in which these effects will be detected will be by a comparison of the curves for various seasons developed from the equations, and he gave assurance that these effects would be considered.

5. REPORT ON PROGRESS OF WORK BY DEPARTMENT OF AGRICULTURE. Mr. A. C. Watson reported that the work of his department is about on schedule, and that most of the ten parts of the study on the use and management of land and cover have been started and some are completed. The study on water for irrigation and rural use is well underway. Because most of the lands irrigated, or to be irrigated, are in the path of industrial or urban development, the influence on the impact of urban development, as it will relate to irrigation, is expected to be profound. Concern was expressed over some of the best agricultural land being diverted to industrial and urban uses. Preliminary estimates of the number of acres to be irrigated by 1975-1980, indicate that from then on, acreage of irrigated land will taper off and probably gradually be reduced. In reference to small dams and reservoirs, for drainage areas of less than one square mile, Mr. Watson indicated that there will be opportunities for such small projects as well as those in the upstream auxiliary reservoir program being made jointly with the Corps of Engineers. Mr. Watson's full report is Appendix C hereto.

6. SMALL DAMS AND THEIR JUSTIFICATIONS IN THE DELAWARE BASIN. The following four presentations by members of Soil Conservation Service, Department of Agriculture, are related to the studies on the upstream auxiliary reservoir program by the C. of E.-SCS Joint Work Group:

a. Introduction. Mr. John Tinivell explained that the place of the small dams in the Delaware basin program depends upon their significance in and relationship to upstream problems related to flood damages, water supply, recreation, pollution control and agricultural water management, and upon the feasibility of fitting them into an overall reservoir program including both large and small structures. A copy of his report is attached as Appendix D hereto.

b. Hydrology. Mr. Vincent McKeever described the hydrologic procedures which consist of two principal phases: (1) Hydraulics and hydrology used in the design of the structures; and (2) Methods and procedures used for evaluating their effects on stream flows. A copy of his report is attached as Appendix E hereto.

c. Sediment Relationships. Mr. G. R. Hall discussed the relationship of geology to sedimentation production and sediment problems. A copy of his report is attached as Appendix F hereto.

d. Economics. Mr. L. R. Shulk discussed the appraisal of agricultural damages and stated the same general principles of flood water damage appraisal apply to urban and agricultural property. Most of the discussion treated the methods of appraisal flood damage to growing crops. A copy of his report is attached as Appendix G hereto.

e. In response to questions and comments, Mr. Tinivell stated that the 36 sites in the upstream auxiliary reservoir program selected for detail study had been analyzed not only from the viewpoint of engineering feasibility, but also with respect to physical features such as road, railroads, etc., in the affected area. He added that it was not yet known how many of the dams could be actually built from the standpoint of economic feasibility. Colonel Powers pointed out that the agricultural damage study will not give the specific number of required small dams, but that it will give criteria to be applied in the evaluation of particular projects. Regarding cost estimates Mr. Tinivell agreed that the annual maintenance costs would vary with the sizes of the structures, and that the Joint Work Group had a source of unit costs for construction from the experience of the SCS in its PL 566 program.

7. REPORT ON PROGRESS OF WORK BY CORPS OF ENGINEERS. Mr. Russell Morgan, Chief of the Valley Report Group, stated the work in his group has progressed to where they are now making initial use of the hydrologic and economic tools of which he spoke at previous meetings. These were used in connection with an appraisal of the relative merit of the various sites included in the list reported on at the fourth meeting. He gave a resume of the work done, and currently underway in the various units of his office. Mr. Morgan's report is attached as Appendix H hereto.



8. REPORT ON PROGRESS OF WORK BY THE DEPARTMENT OF THE INTERIOR. Mr. D. R. Gascoyne summarized the work being done by the National Park Service, the Geological Survey, and the Fish and Wildlife Service, and indicated that these three agencies were maintaining their schedules for the completion of their reports. He announced that the final draft on recreation resources of the basin will be submitted to the District Engineer not later than 31 January 1959, that the first group of three sub-basin reports will be submitted within a few days and that the second group is expected to be completed about 1 August 1958. A copy of this report is attached as Appendix I hereto.

9. STATUS OF AND FINDINGS FROM THE U. S. GEOLOGICAL SURVEY'S REPORT. a. The report by Mr. Gerald G. Parker indicated that the Geological Survey and the Department of the Interior plan to eventually cover the entire United States with such studies as are now being made on the Delaware River basin. This first general hydrologic evaluation of a major river basin (the Delaware) integrates and evaluates the many elements of water-supply problems and is intended to provide the broad foundation upon which all preliminary planning and subsequent detailed studies can be based. An equation was given for a water budget; then using the records for a 30-year period, it was shown that more than half of the total precipitation in the basin is lost through evapo-transpiration. About 36% of the average annual water crop, potentially available for harvesting in the basin, is now being withdrawn. It was emphasized that the available water can be used repeatedly as long as it is not despoiled or depleted by its use and, therefore, the most important consideration is consumptive use. It is estimated that less than 5% of all water withdrawn from the basin is consumptively used. Based on a forecast of a national increase of 76% in water use from 1955 to 1975, it appears that more storage must be provided, better use must be made of available water and water conservation must, eventually, be practiced rigidly. Methods of augmenting the water supply were mentioned. Mr. Parker's presentation covered briefly the ground water supplies in both the upper and the lower parts of the basin. It was the speaker's view that water-resources problems are related more to quality-of-water aspects than they are to quantities of water available and the research into the quality-of-water aspects of the water supply should be emphasized. A copy of this report is Appendix J hereto, which is being distributed, for work purposes, only to members of the Committee and staff of the agencies they represent.

b. Mr. Klashman indicated that there was a difference between the average daily water use figure presented by Mr. Parker and that which the Public Health Service was using in its report on municipal and industrial water use, and asked for the source of the water use figure of 4,750 mgd and whether that figure reflected reuse. The reply was to the effect that the 4,750 mgd was compiled from data from various sources, that it represented fresh water use only (saline water use in lower part of the basin was excluded) and that it did include reuse. In view of the

fact that the Corps had assigned to the Public Health Service the task of preparing a report on municipal and industrial use, the Chairman requested Mr. Klashman to arrange a meeting with Geological Survey representatives for the purpose of resolving any differences which may appear in the detail data from which the average daily consumption was compiled.

c. Mr. Ford requested the Chairman's permission to submit a memorandum giving New York City's comment on Mr. Parker's discussion with particular regard to the inference that diversions were made from low flows. 1/

d. Colonel Powers expressed a desire to make the theme of the next meeting a discussion of figures on water use and the methods used to obtain these figures. The Public Health Service and the Department of Agriculture were requested to prepare talks on means of arriving at water use figures. Also, state members were requested to furnish to Committee members and the Chairman by the first of September their current estimates of projected demands and their projected plans for meeting those demands; however, if the information were not complete, then the states should furnish whatever information they had by that date.

1/ Subsequent to the meeting Mr. Parker amended his statement, which appears in that form as Appendix J, to stress that the diversions by New York City are from storage accumulated during period of high flow and that releases from the City's reservoirs during periods of drought or low flow actually increase the normal low flow of the river. Also, Mr. Parker wrote a letter of clarification to Mr. D. R. Gascoyne, who represents the Department of the Interior on the Coordinating Committee, and furnished copies of that letter to Mr. Ford and to the Chairman. Mr. Ford, in turn, indicated by letters to Mr. Parker and the Chairman that he was satisfied with Mr. Parker's clarification that New York City's diversions are from high-flows which would have been wasted had they not been impounded. Although the effects of the City's reservoir operations on river low flows has been clarified to the satisfaction of the Member from New York City, the Chairman desires to call attention to the fact that in the comparison of estimated maximum consumptive use (670 mgd in 1955) with the estimated minimum 7-day flow at Wilmington (1,300 mgd; recurrence interval of 20 years), the diversion of 350 mgd by New York City is included in the 670 mgd. In view of Mr. Parker's clarification this comparison should be accepted as an indication of the order of magnitude of water use vs. water available during a selected period of low flow. The figures used in this comparison are not to be interpreted as being indicative of the degree of depletion of available low flows imposed by known water uses and diversions.

10. STATUS AND FINDINGS FROM THE U. S. FISH AND WILDLIFE SERVICE'S REPORT. a. Mr. B. F. Donley indicated a desire to encourage and advise the Corps of Engineers in the selection and preservation of the better marshes in the vicinity of Philadelphia. The marshes are habitat for wildlife, broadly speaking -- undomesticated animals. In Mr. Donley's opinion few people are correctly informed on this subject. He used Sullivan County, New York, to illustrate the economic importance of hunting and fishing, which are dependent upon proper management of fish and wildlife. Mr. Donley said he wanted to bring these facts to the attention of the Committee and to state that when fish and wildlife are being considered in planning the Service does not want them to be considered as a fringe benefit. Appendix K hereto contains Mr. Donley's remarks in full.

b. Colonel Powers stated that as far as he was concerned, the fish and wildlife would not be considered as fringe benefits. The Chairman then suggested that the Fish and Wildlife Service prepare for distribution some of the reports it is now working on, and summarize its activities on the comprehensive report for the next meeting in order that the background data will be understood.

11. SUMMARY OF STUDY OF RECREATION HABITS AND PREFERENCES OF THE DELAWARE RIVER BASIN POPULATION BY THE NATIONAL PARK SERVICE. a. Mr. L. H. McDowell stated that in order for the National Park Service to formulate a plan for the utilization of the recreation resources of the Delaware River basin which would meet the non-urban recreation needs of the basin population, the preferences of the population had to be determined first. He then outlined these preferences which were determined by a field study made by the National Recreation School through the facilities of Audience Research Incorporated. A copy of this report is attached as Appendix L hereto.

b. Colonel Powers commented that the report on the field study was a very substantial addition to the survey effort and provided that information needed to support and understand the findings to be presented in the final report by the Park Service.

12. REPORT ON PROGRESS OF STUDIES BY DEPARTMENT OF COMMERCE. Mr. Richard Ackroyd stated that there are seven agencies of the Department of Commerce that are participating in the Delaware basin survey and that Mr. Wardwell would present a report for the Office of Business Economics. The Bureau of the Census work in connection with the survey has been given to the Office of Business Economics for use in its economic base survey and a report on the work of that Bureau would be included in the report by OBE's representative. The Weather Bureau was represented by Mr. T. S. Nordenson who advised that they are preparing a report on hydrologic data for the survey. Mr. Ackroyd introduced Commander Wm. F. Deane, Baltimore District Office of the Coast and Geodetic Survey. This was the first opportunity Commander Deane had to attend a



meeting of the Committee. None of the remaining cooperating agencies of the Department of Commerce is actively engaged in studies for the survey at this time and so had no report to offer. These include the Office of Area Development, Office of Under Secretary for Transportation and Bureau of Public Roads.

13. SUMMARY OF PROJECTIONS MADE BY THE OFFICE OF BUSINESS ECONOMICS.

a. Mr. C. A. R. Wardwell reported that the final report had been completed and would be submitted to the District Engineer within a week. There were very few changes made in the preliminary figures which were previously submitted and distributed. Preparation of the final report involved mostly the preparation of written descriptions of the analysis underlying the procedures used.

b. The main use of the report will be in connection with studies to estimate probable water demands over the next 50 years. The population of the whole Delaware service area is expected to increase 95%, and for the Delaware basin and coastal region combined to increase 103%. It is estimated that in 50 years the increase in the number of households in the Delaware service area will be 108% of the 1955 number. These estimated increases will have a direct bearing on the increased water needs. Employment projections also must be considered, but while the increase in this instance is estimated roughly as 98%, production per employee will be greatly increased. For the entire country, production per employee is expected to increase five-fold. The speaker suggested that serious consideration be given to the regional income figures, for these are the measure of goods and service output, and could be used as a basis for estimating water demands. It was stated that the estimates for the entire Delaware service area are believed to be more realistic than those for the eight sub-regions.

c. When asked by Mr. Shanklin if the populations could be given by counties, Mr. Wardwell indicated that OBE has projected the populations by sub-regions only, but with those figures and the facts known by the states regarding their own counties, the states could make their own figures for the counties. Dr. Kaplovsky indicated that the State of Delaware had done so with satisfactory results.

14. REPORT ON PROGRESS OF STUDIES BY THE FEDERAL POWER COMMISSION.

a. Mr. John H. Spellman referred to the estimated amounts of future utility power requirements which he presented at the previous meeting. Since that time his agency has been completing the power market report which will be incorporated into the report being prepared for the survey. The market area selected for study, which is Power Supply Area 4 and part of area 5, requires some 12-million kilowatts. This is one of the largest power pools in the country. These requirements will be increased to between 25- and 27-million kilowatts within the next 20 years. This indicates that there will be a market for any hydroelectric power which



may be developed under the comprehensive plan for the basin. He stated that a paper would be presented at the next meeting describing the Commission's methods of evaluating hydroelectric power and how it might be utilized.

b. Mr. Spellman, referring to the licensing responsibility of the Commission under the Federal Power Act, stated that the project must be best adapted to a comprehensive plan. It was indicated that in addition to developing tools to be used by the Corps of Engineers in its projects, the Commission is concerned with the methods of developing the plan and of best utilizing the water resources of the basin. Hope was expressed that a little more definite information, in respect to power values, would be available for the next meeting.

c. With reference to the concern expressed by Mr. Donley of the Fish and Wildlife Service, Mr. Spellman remarked that the Commission has strict licensing requirements to protect fish and wildlife.

15. REPORT ON PROGRESS OF STUDIES BY PUBLIC HEALTH SERVICE. Mr. Lester M. Klashman stated the revised draft of the report on municipal and industrial water use will be submitted to the District Engineer in early August 1958. Additional sections to this report are being prepared covering the municipal systems of New York City and Philadelphia. The report on stream quality in the basin is in preparation. That portion of it which covers the basin north of Trenton, New Jersey, and includes the results of the survey that the Public Health Service conducted last summer in the Port Jervis-Trenton section of the basin, has been sent to the Water Quality Work Group for review and comment. The results of the classification study of the New York State Water Pollution Control Board, currently underway in the New York section of the basin, will be incorporated into the final report on Stream Quality. The Water Quality Work Group will also review the report on the tidal section which is now being prepared. The inventory of municipal and industrial wastes within the basin has been substantially completed, and will be summarized and forwarded to the District Engineer, for distribution to the Committee. Mr. Klashman expressed hope that the revised figures to be obtained from the inventory of municipal water supplies, currently progressing satisfactorily, can be incorporated into the report on municipal and industrial water use.

16. SUMMARY REPORT ON THE RESULTS OF THE WATER QUALITY STUDIES MADE IN THE NON-TIDAL SECTION OF THE BASIN BY THE PUBLIC HEALTH SERVICE. Mr. Robert V. Thomann presented a paper describing stream quality conditions in the non-tidal portion of the basin which included the results of the quality survey conducted by the Public Health Service during the summer of 1957. The results of the water quality studies will form the basis for predictions of future water quality conditions under the proposals of the comprehensive plan, and analyses could then be made to determine

the costs and benefits attributable to the predicted changes in water quality. The paper is attached as Appendix M hereto.

17. STATUS REPORT ON WORK OF C. OF E. - SCS JOINT WORK GROUP. Mr. M. R. Iakisch of the Corps of Engineers showed a slide of a map showing the 36 sample sites selected by the C. of E. - SCS Joint Work Group making the study for the upstream auxiliary reservoir program. He explained the assumptions and criteria used to prepare detailed design and cost estimates for the selected sites. He said that studies are now in process to generalize the design data, developed for the flood control structures of the 36 sites, for use in evaluating the remaining 300 upstream auxiliary reservoir sites. Mr. Iakisch's full report is attached as Appendix N hereto.

18. REPORT ON ORDER OF MERIT OF PROJECTS SELECTED FOR STUDY. a. Mr. Russell Morgan, Chief, Valley Report Group, Corps of Engineers, reported on the assumptions and procedures used for selection of the 39 main-stream storage projects which seem most probable of eventual justification. Their geographic locations show a reasonably uniform distribution in the basins of the Lehigh, Schuylkill and Brandywine-Christina Rivers. Mr. Morgan outlined a typical plan for ultimate development of the basin which would include about 1,700,000 acre-feet of water storage at six sites in the upper part of the basin at and above the Tocks Island site. An additional 160,000 acre-feet of storage seems practical at seven sites on tributaries to the reach of the Delaware from Tocks Island to Easton. Five sites in the Lehigh basin could provide an additional 378,000 acre-feet of storage and five sites on tributaries to the reach of the Delaware from Easton to Trenton would provide 168,000 acre-feet of storage. In the lower part of the basin, seven sites in the Schuylkill and four sites in the Brandywine-Christina basin would provide 286,000 acre-feet and 170,000 acre-feet of storage, respectively. This typical plan would provide in 34 projects, a total of 2,862,000 acre-feet of storage for water supply purposes and could be used to provide minimum flows of 8,200 cfs in the Delaware River at Trenton, 1,450 cfs in the Schuylkill River at Philadelphia, and 330 cfs in the Brandywine at Wilmington.

b. Colonel Powers emphasized that the detailed list of 39 possible dam sites is far from final. Many may never be built and some of those finally decided on may not be built for 25 years or more. For these reasons the Chairman indicated that the list of potential sites and the map showing their locations would not be published as a part of these minutes, but that two copies of Mr. Morgan's paper with the list and map would be furnished for study purposes to each member of the Committee, and to the Delaware River Basin Advisory Committee and the Interstate Commission on the Delaware River Basin.

c. In response to a question by Mr. Shanklin as to what comments were desired in the near future relative to the grouping of sites presented by Mr. Morgan, the Chairman requested the participating

agencies to give him an initial appraisal of the grouping, and to comment on its effectiveness and whether any major discrepancies are discerned.

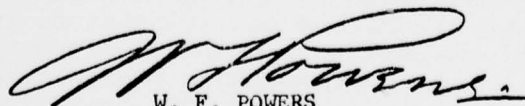
d. The Chairman again requested member-representatives of the states to furnish, by the first of September, a then current estimate of water demands by general location, quantity and time. He offered to arrange conferences in any state or area, upon request.

19. SUGGESTIONS OF TOPICS FOR CONSIDERATION AT NEXT MEETING. a. Colonel Powers announced that the major theme for the next meeting will be water-demand and water-use. As stated in paragraphs 9d and 10b, above, the Public Health Service and the Department of Agriculture were requested to prepare talks or discussions on means of arriving at water-use figures, and Fish and Wildlife Service was requested to summarize its activities on the comprehensive report.

b. After a general discussion as to place and date for the next meeting, the members agreed that it would be held 18-19 September, and the invitation extended by Mr. Peterson and Mr. Ford to hold the meeting in New York City was accepted.

20. VISIT TO DAM SITES. a. Mr. A. C. Watson introduced Mr. Howard Miller, engineer of the local watershed work plan party of the Soil Conservation Service, who described the small dam project being designed for a site on Lollipop Creek, about 1.3 miles above its mouth at White Mills. The design, construction, operation and maintenance of the project are the responsibilities of the local interests under P.L. 566. After a briefing on the project by Mr. Miller, he conducted a bus trip to the dam site, passing through the area effected by the project enroute.

b. The group was then taken to Dyberry reservoir and dam site, which is located about two and a half miles upstream from the junction of Dyberry Creek and the Lackawaxen River in Honesdale. Major George A. Austin, Jr., of the Corps of Engineers, conducted this trip. He described the features and purpose of the project, and explained the progress made since the work was started in July 1957. The estimated project cost is \$4,500,000. The Dyberry project together with the Prompton project, located on the Lackawaxen River, four miles above Honesdale, will control a drainage area of 125 square miles.

  
W. F. POWERS  
Colonel, CE  
Chairman

\* MINUTES OF SIXTH MEETING  
OF THE  
DELAWARE BASIN SURVEY COORDINATING COMMITTEE  
HELD 18-19 SEPTEMBER 1958  
IN NEW YORK CITY

1. OPENING REMARKS. The Committee was convened in the North Lounge of Hunter College on 18 September 1958 by Colonel W. F. Powers, Chairman. Colonel Powers expressed appreciation of permission given by Dr. John J. Meng, Dean of Administration of Hunter College, for the use of college facilities for the meeting. He also acknowledged the efforts of Mr. Arthur C. Ford and Mr. V. G. Terenzio of the City of New York in making arrangements for the meeting.

2. ATTENDANCE AND INTRODUCTIONS. a. The following members were in attendance:

Mr. Richard Ackroyd, Department of Commerce  
Mr. Samuel S. Baxter, City of Philadelphia  
Mr. Patrick M. Connell for Mr. John F. Foy, Department  
of Labor  
Mr. Arthur C. Ford, City of New York  
Mr. D. R. Gascoyne, Department of the Interior  
Mr. Maurice K. Goddard, Commonwealth of Pennsylvania  
Dr. A. Joel Kaplovsky for Mr. Richard A. Haber, State of  
Delaware  
Mr. Lester M. Klashman for Mr. Sylvan C. Martin, Depart-  
ment of Health, Education & Welfare  
Mr. Ronald B. Peterson, State of New York  
Mr. George R. Shanklin for Mr. Salvatore A. Bontempo, State  
of New Jersey  
Mr. John H. Spellman, Federal Power Commission  
Mr. Alvin C. Watson, Department of Agriculture

b. Colonel Powers announced that Mr. Salvatore A. Bontempo has replaced Mr. Joseph E. McLean as member of the Coordinating Committee for the State of New Jersey, and expressed regret that Mr. Bontempo was not present. The Chairman then introduced Mr. Don Horton of the Office of the Secretary of the Army, Mr. Edward W. Landenberger of the Office of the Chief of Engineers and Mr. Paul A. Jaenichen of the North Atlantic Division Office. The members introduced the various representatives from their respective agencies. Mr. Baxter announced that Mr. Murray B. McPherson has replaced Mr. Gerald E. Arnold as alternate member of the Coordinating Committee for the City of Philadelphia.

c. The names of the 110 persons who registered and attended the meeting are listed in Appendix A hereto.

\* See minutes of next meeting for corrections.



3. MINUTES OF PREVIOUS MEETING. a. The following modifications were requested in the minutes of the fifth meeting held in Honesdale, Pa. on 26-27 June 1958:

(1) On page 2, paragraph 4b, delete "incorporated into this report as far as possible" and insert in lieu thereof "considered in the report".

(2) On page 4, paragraph 9b, add the phrase "In response to a question raised by the Chairman," at the beginning of the first sentence which starts "Mr. Klashman indicated .....".

(3) In Appendix J (which had a limited distribution), page 6, 4th paragraph, in the denominator of the equation "bgd" should read "mgd".

b. The minutes were approved subject to the above modifications.

4. REPORT ON MEETING OF PUBLIC HEALTH SERVICE AND U. S. GEOLOGICAL SURVEY REPRESENTATIVES HELD TO RESOLVE DIFFERENCES IN WATER USE QUANTITIES. a. Mr. Klashman reported that in accordance with Colonel Powers' request at the previous meeting of the Coordinating Committee, he met, in New York City on 10 July, with representatives of the Department of the Interior, the U. S. Geological Survey, the Corps of Engineers and the Public Health Service. The meeting was held to resolve differences in the water use figures presented by the U. S. Geological Survey and the Public Health Service at the previous meeting. As a result of the meeting held on 10 July it was agreed that:

(1) There should not be any duplication or contradiction of the water use figures in the various appendices of the comprehensive report called for in the Corps of Engineers data book.

(2) To avoid confusion, the Public Health Service and the U. S. Geological Survey will resolve any differences in the water use figures and the same figures will be presented in their respective appendices.

b. Mr. Klashman said that he believes Mr. De Falco, of the Public Health Service, and Mr. Kammerer, of the U. S. Geological Survey, have resolved all differences in the water use figures and that these two agencies are now in substantial agreement. He said that the water use figures submitted by New York and Pennsylvania have raised a few differences. These differences will be discussed with the representatives of the agencies concerned in the two states and agreements will be reached. Either the states will be convinced that the figures of the Public Health Service are correct or the figures of the states will be accepted by the Public Health Service. The Chairman then remarked that anyone with a decided difference in water use figures, should present his reason for the difference to the Public Health Service.

c. Mr. Shanklin asked if the Public Health Service was anywhere near agreement with the figure given in Mr. Parker's report (appendix J of the minutes of fifth meeting) as 270 mgd for estimated consumptive use in 1955 for the area within the basin. Mr. Klashman replied that the quantity of 273 mgd reflected irrigation and rural use figures, the determinations of which are a responsibility of the Department of Agriculture, and stated that he believed that the municipal and self-supplied industrial figures could be adjusted so that there would be agreement. The Chairman commented that as long as the technicians of the two services agree on the order of magnitude for the various uses, they should be able to decide on definite figures.

d. Mr. Baxter suggested that whenever figures on water use are given, it be clearly noted whether they represent consumptive use or raw water use. Mr. Klashman agreed that clarification was necessary and said he would go over this with Mr. Baxter. Mr. Morgan recommended that all of the present water usage be treated in terms of withdrawal.

e. A general discussion as to the significance of the term "withdrawal" followed, and the Chairman stated that Mr. Morgan and his work group are concerned with the quantity of water which must be available at certain points along the river to fulfill requirements. The Chairman concluded with the remark that in the presentation made at the previous meeting by Mr. Parker, he tried to give a broad picture of water use in the basin, and as such it was not applicable to a specific project or point in the basin, in any way, shape or form.

#### 5. STATEMENT FOR THE DELAWARE RIVER BASIN ADVISORY COMMITTEE.

a. At the request of the Chairman, Mr. Walter Phillips, Executive Secretary of the Delaware River Basin Advisory Committee, commented on the meeting of that Committee held 10 July at Washington Crossing, Pa. Mr. Phillips said that it was the first time that the Governors and Mayors ever met with the representatives of the Corps of Engineers to discuss the Delaware River survey. The meeting was attended by Governor Leader of Pennsylvania, Governor Meyner of New Jersey, Governor Boggs of Delaware and Mayor Wagner of New York City. Governor Harriman of New York was represented by Mr. Sharon J. Mauhs, Commissioner of Conservation. Mayor Dilworth of Philadelphia was represented by Mr. James Tate, President of Philadelphia City Council. The members of the Delaware River Basin Advisory Committee, and the Board of Directors of the Delaware River Research Corporation were also present. The Corps was represented by Major General E. C. Itschner, the Chief of Engineers, Colonel Clarence Renshaw, Division Engineer, North Atlantic Division and Colonel Powers.

b. During the meeting Colonel Powers described the aims and purposes of the comprehensive survey and told how it was being conducted. Dr. Roscoe Martin, of Syracuse University, described the character of the governmental organization study he is directing for the Advisory Committee, and the questions at issue. Mr. Jones, Chairman of the Committee on Public Information of the Delaware River Basin Research Corporation, described the plan that has been developed by that agency to acquaint civic groups and the general public with the work being done in the water resource survey.

c. Mr. Phillips said that the Governors and Mayors made statements about the interests of their respective jurisdictions in the water resources of the basin. Copies of the statements may still be available and those who are interested should direct their requests to Mr. Phillips. He said that the Governors and Mayors in a closed session with members of DRBAC appeared to be well informed and indicated that they are deeply interested in the survey. Mr. Phillips feels that their opinions on the final report will be really worthwhile.

d. Colonel Powers said that he had been with the Governors of Delaware and New Jersey since the meeting of 10 July, and that both had gotten a great deal out of the meeting and are well aware of the job being done.

6. REPORTS ON PROGRESS OF WORK. a. In his introduction of the presentation of reports on progress, the Chairman commented that the Coordinating Committee meets from time to time in order that the members may summarize the results of the work accomplished since the previous meeting, explain the methodology and state the source of data used. In this way the members, the public and the other agencies not represented on the committee can learn of the progress being made, and how the problems are being met. The Chairman requested that comments be expressed freely so that they can be given full consideration.

b. Department of Agriculture. (1) Mr. Alvin C. Watson then reported that the operations of his Department in this survey were about on schedule and that the report on "Use and Management of Land and Cover Resources," the outline for which is appendix 3-01.6 of the Data Book, is in the final stage except for sections IX and X, ("Agricultural Problems Associated with Installation of Reservoir Program" and "Agricultural Benefits Associated with Installation of Reservoir Program", respectively). Work on these sections will progress when the states have advanced to further stages in program formulation. The report on "Water for Irrigation and Rural Use", the outline for which is appendix 3-01.11 of the Data Book, described by Mr. Watson as a lengthy document, will be submitted to the Corps of Engineers at an early date.

(2) Mr. Watson said that work on the small upstream reservoir program, being accomplished by the Joint Work Group is progressing. As far as possible the results of the initial work have been put on paper. A number of sites has been selected for more detailed evaluation. These have been classified into various categories, and a certain number of them appear to be justifiable on the basis of flood control benefits alone. In other instances the benefit-cost ratios, considering flood control only, are slightly below unity and in other instances substantially below unity. The information on these sites has been furnished to the Public Health Service, the National Park Service and the Fish and Wildlife Service for the evaluation of benefits from possible uses of these projects for purposes which are of particular interest to these agencies. Assurance was given that no possibility for multiple use of these sites for recreation, water supply or wildlife will be overlooked.

c. The Corps of Engineers. (1) Mr. Russell Morgan, Chief of the Valley Report Group, announced that a supplemental flood damage survey in the Delaware River basin was started in August and was nearly completed. It augments the survey made shortly after the August 1955 flood, so as to cover areas not previously surveyed and to obtain flood damage data for stages above and below those of the 1955 flood. Referring to the order-of-merit study reported on at a previous meeting, Mr. Morgan stated that the information from that study plus data from the initial projection of water requirements have been used as bases for the formulation of five plans of development. Two other plans slanted toward development of hydro-electric power and recreation potentials are also under consideration. The third major task reported on was that of exploring ways and means of making projections of water requirements for domestic and industrial uses. Mr. Morgan's full report is Appendix B hereto.

(2) Mr. George R. Shanklin asked if Mr. Morgan wanted any information regarding the seven plans from the states at this time. He was told that at the present time, the real goal is to find the best plan for the basin based on engineering considerations, after which comments will be requested and taken into consideration.

d. The Department of the Interior. (1) Mr. D. R. Gascoyne reported that the three bureaus of the Department of the Interior are progressing on their studies according to schedule and without difficulties. The Geological Survey's general hydrology report was expected to be released to the Corps of Engineers within the next month. The comments received on the National Park Service recreation report have been considered and



the revised draft was receiving final editing and was being prepared for reproduction at a later date. Work has been started on a non-urban recreation plan for the State of Delaware. This will serve as a pilot study for the remainder of the basin. The Fish and Wildlife Service has submitted to the Corps of Engineers drafts of three sub-basin reports. A fourth sub-basin report will be sent to the Corps shortly. Two more such reports are ready for final review within the Service. Mr. Gascoyne's full report is Appendix C hereto.

(2) The Chairman requested that Mr. Ferguson describe the nature of the U. S. Geological Survey report. Mr. Ferguson said that the USGS work in relation to the Delaware basin survey was a "general hydrologic treatment of the basin in order to give a basin-wide perspective". It includes the assignment by the Corps in certain new geologic work which was included in Mr. Parker's first draft of the report. This section of the report will soon be given to the Corps of Engineers for distribution. Included in the hydrologic report will be a generalized treatment of water use data because the USGS is of the opinion that such treatment "is inherent in any hydrologic report" since one "cannot deal with availability (of water) without dealing with demand for water". In its ground water studies, the USGS is seeking to evaluate the sustained yield, and the demand thereon. The data on water use will be reconciled with that in the Public Health Service report. It was stressed that the USGS presentation of data on water use would be "general", whereas the presentation by the Public Health Service would be in more detail. This same view was expressed in response to Mr. Watson's query regarding the USGS presentation of data on water use in irrigation; the USGS coverage would be general, the coverage by the Department of Agriculture would be in detail. Mr. Ferguson stated that after Mr. Morgan and his staff had an opportunity to see the draft, the question of its presentation in the appendix will be up for discussion.

(3) Colonel Powers stated that there will be a certain amount of overlapping in reports and it is necessary that any overlapping be pointed out and explained. He suggested that when the USGS hydrology report has been reviewed by the Corps, these two agencies meet to make sure the methodology is consistent. Mr. Ferguson stated that the USGS will report on "the natural hydrology" while it is his understanding that the Corps will report on hydrology in relation to the development of water availability.

(4) In response to a question by Mr. Shanklin, Mr. Ferguson said that the first draft of the USGS report covered the field as outlined in the Data Book, the report now being prepared will give broader coverage.

(5) Mr. Underhill questioned if the National Park Service will evaluate, for recreation purposes, the reservoirs which are being considered for all other purposes. Mr. McDowell answered that progress has not yet reached that point, and that when Mr. Morgan had developed an operational method for each of the reservoirs in the final plan, then recreational use will be evaluated on that basis. Mr. Underhill remarked that he and some of his associates are of the opinion that recreational use of projects should not be incidental to other uses - the management for recreation is as important as for any other use. Mr. Gascoyne stated that there are actually seven systems of reservoirs under consideration, and that it would be an almost impossible task to evaluate recreation in all seven plans in the detail desired. However, Mr. Gascoyne gave assurance that when all factors have been considered and the final plan has been drawn, they will be quite definitive in their recreation plan and the evaluation thereof.

e. The Department of Commerce. (1) Mr. Ackroyd reported that the Office of Business Economics submitted the final draft of its report on the economic base survey to the District Engineer in June and that the studies of the Weather Bureau are substantially completed.

(2) A question was raised by Mr. Chavooshian as to whether extractions from the OBE report can be used in reports other than the one being prepared for Congress; if used, should specific acknowledgement be made as to the source of the data extracted; if extracted data are used and up-dated by the agency using it, should general acknowledgement be made of the source. Colonel Powers stated that the OBE data were given to the members in their official capacities; the data are not classified as secret and since it has been given to them it is something they know. If used, credit should be given where due, and since OBE may still update certain material therein, the report should be identified as OBE's tentative report for the survey and not the final report.

(3) Mr. Watson referring to the OBE projections which extend to 2010, asked what was the thinking in connection with making projections to 2060. The Chairman answered that as far as OBE figures are concerned, 2010 is about the limit to be considered for projecting control and regulation of the flow of the Delaware River. However, if in agricultural use trends to 2060 can be foreseen which would be consistent with the trends projected to 2010, then further projections can be made for agricultural use. All figures, as far as possible, should be related to OBE data. A statement should be made to tell what is expected to happen beyond the period for which projections are made, and what it might mean in terms of water demand. Dr. Kaplovsky remarked that in the study made by his State inclusion of projections on land use and the availability of land for agriculture

to the year 2060 was unavoidable because of the importance attached to it by the State of Delaware Agriculture Department. The Chairman said that if it is necessary to make some special provision in the planning for Phase II projects (those needed beyond 2010) so as not to preclude later developments that will be needed to provide water for agricultural use, then it will be done.

f. The Public Health Service. (1) Mr. Lester M. Klashman stated that the report on municipal and industrial water use would soon be submitted to the Corps. The data available for the study of the tidal section of the stream are being evaluated and prepared for computer analysis as discussed by Mr. Diachishin at the previous meeting. It is expected that this part of the report will be completed by the end of the calendar year. The data on proposed dam sites and systems are being reviewed with Public Health Service counterpart agencies in the States for any conflicts with state water supply and water pollution control programs. The information collected to date has been furnished to representatives of the Corps and discussed with them. A PHS staff member has been assisting the Corps' staff in making preliminary projections of municipal and industrial water use.

(2) In response to a question by Mr. Peterson as to what data were available to the PHS on the quality of water in the upper basin, Mr. Klashman answered that in this respect his agency has limited information which is considered inadequate for the report; however, the New York Water Control Board is classifying the streams under a program recently initiated and additional data are being made available. Mr. Peterson pointed out that a great deal of information was available in the Albany Office of the USGS, and that during the past year the State, working with the USGS, had collected some information on water quality. Mr. Klashman was familiar with this source. However, this material was largely on water availability, and the PHS had obtained some data from the USGS but not the more current data gathered in the USGS study during the past summer. It was understood that the latter data will be made available to the PHS by the USGS.

(3) Mr. Ford said that the New York City Board of Water Supply has collected a considerable amount of water quality data for the East and West Branches of the Delaware and for the Neversink River, and that the PHS has had access to these records. Mr. Klashman acknowledged being aware of these records and expressed his appreciation to Mr. Ford for making them available.

g. The C. of E. - SCS Joint Work Group on Upstream Auxiliary Reservoir Planning. (1) Mr. Vincent McKeever stated that the Joint Work Group's report will soon be submitted to the District Engineer for review and comment. The introduction is completed. The hydrologic design criteria section and the section on hydrologic storage requirements are almost completed. The Group wants to include a watershed yield study



in the latter section and it will be completed in the next few weeks. Mr. McKeever said that in the design of dams consideration will be given to criteria adopted by the states as well as to Federal agency requirements. He cited the structural criteria which were adopted for preparation of preliminary designs. Mr. McKeever's full report is Appendix D hereto.

(2) In response to a question by Mr. Hazzard, Mr. McKeever stated that he thought it would be possible to modify the design of outlets to permit releases of water from the bottom of impoundments, the purpose of such releases being to meet fisheries management needs, especially during periods of low flows.

h. The Federal Power Commission. Mr. Ross said that progress was made in two phases, the first being a study to determine the feasibility of including power development projects in the basin plan, and the other being an evaluation of power. Mr. Ross summarized the material pertaining to the first phase and Mr. Woll's presentation (see paragraph 9) covered the second phase. Mr. Ross indicated that at the work group meeting held in the District Engineer's office on 5 September, he presented a plan (F) developed by the FPC. This plan was such as to stress power development. Power potential under this plan is substantial and its development need not be in conflict with other purposes. The preliminary studies for this plan are not at all complete, but an evaluation of the study material thus far developed indicates that there may be three or four projects which have attractive possibilities. The present FPC study is aimed at creating power schemes which will be compatible with other project purposes for which needs may be predominant.

7. PUBLIC HEARING ON A BARRIER IN THE ESTUARY. The Chairman announced that the Corps of Engineers will hold a public hearing on 20 October in Wilmington, Delaware on the proposal to build a barrier dam across the Delaware River. There has been an official suggestion from local interests that the barrier be erected in the vicinity of New Castle. The Chairman pointed out that the purpose of the hearing is not to come up with a definitive plan and final recommendations, but to find out the hopes and fears of the people who will be affected by the barrier. The Chairman said that, like several others, he is nowhere near ready to make recommendations, but that a public hearing is the initial step in such a study and is necessary in order to ascertain every possible area of interest which, in the opinion of the people who will be affected, it is necessary to cover.

8. IMPORTANCE OF ESTUARIES TO THE ATLANTIC MENHADEN RESOURCE.  
a. Mr. Fred June presented a paper entitled "The Relation of the Estuary to the Atlantic Menhaden Resource". He demonstrated how the well-being of a number of marine organisms which support the coastal fisheries are dependent on the continued existence of the unique environment of the Atlantic Coast, and focused attention on the relation of the estuary to the biology and life history of the Atlantic menhaden. Mr. June's paper is Appendix E hereto.



b. Mr. Ackroyd asked about the effects of a salt water barrier across the Delaware. Mr. June pointed out that such a barrier would effect the area presently being used by such fish. In response to a question by Colonel Powers as to whether adverse effects could be foreseen as a result of a barrier, Mr. June explained that to anticipate such effects it would be necessary to anticipate effects on the entire ecology, including effects on many plants and other animal species which play a part in the well-being of the menhaden. Colonel Powers asked if any conclusive information could be compiled within a time allowed for the present preliminary study of the barrier as it will be included in the comprehensive study of the basin. Mr. June explained possibilities of adopting methods to such a period, but concurred in the remarks of Mr. Gascoyne that in the 1-1/2 years remaining anything very conclusive could not be expected. Colonel Powers asked if fish might be artificially provided the needed habitat. Mr. Gascoyne indicated that specific answers were very limited in relation to the entire scope of possibilities to be considered.

c. Mr. Shanklin asked how oysters compared with menhaden in their requirements. Mr. June explained that of the 20-odd commercially important estuarine species, only four or five are being studied, and that it would be impossible to go very far in comparing demands among them.

d. Colonel Powers closed the discussion by pointing out that in addition to the tangible values affected by public works there are intangible values as well which bear importantly on justification for recommended projects, and that the present paper and discussion were excellent means of showing the group the seriousness and complexity of some of the problems involved in the evaluation of such works.

9. CRITERIA FOR EVALUATION OF HYDRO-ELECTRIC POWER. a. Mr. L. B. Woll of the Federal Power Commission described the principal economic criteria which the Commission proposes to use in determining the values of power from potential hydro-electric developments in the basin. He explained how such power is evaluated and compared the current market with the estimated market of 1980. The possibilities of nuclear power as an economical source of power are now too uncertain to be counted on in utility plans for the near future and, therefore, power sources alternative to potential hydro-power developments will probably be privately-financed conventional steam-electric plants. Mr. Woll gave a resume of steam-electric power costs and stated the information in the resume was used to calculate the annual costs of such generation for alternative power plants at Philadelphia, Portland and Martin Creek, all in Pennsylvania, and Holland, New Jersey. Mr. Woll's full report is Appendix F hereto.

b. Colonel Powers remarked that the question of how and when nuclear energy for power generation would be considered had been asked at almost every meeting and now Mr. Woll has given the answer. It was the Chairman's understanding that the FPC view was that it would be best to set aside for the present time, serious consideration of nuclear energy as a power source in the present planning. Colonel Powers said that as conditions change in the future, any hydro-electric projects included in the plan will be reconsidered when more facts are known regarding the development of nuclear energy as a power source and when that source becomes more competitive in comparison to hydro-power.

10. A SUMMARY OF FISH AND WILDLIFE SERVICE ACTIVITIES COMPLETED AND CONTEMPLATED IN CONNECTION WITH THE SURVEY. Mr. B.F. Donley said that the Fish and Wildlife Service made a basinwide inventory of fisheries, waterfowl and aquatic fur animals in the summer of 1956, and submitted a fishery resource situation map to the Corps during the summer of 1957. The service made a monetary evaluation of the anticipated fishery of potential reservoir sites from information furnished by the Corps. In an effort to eliminate the possibility of overlooking some facet or segment of fish or game importance, the basin was divided into sub-basins for study purposes. Drafts of the sub-basin reports had been scheduled for submission to the Corps during the calendar year of 1958. Mr. Donley admitted that these reports have not been issued with speed and regularity but said that recent new assignments of personnel will result in better work more quickly completed. The present plans of the Service call for the continuation of work on its present course until all remaining sub-basins have been reported on in short form and the reports now completed are revised. Mr. Donley's full report is Appendix G hereto.

11. RELATION OF WATER YIELDS TO RESERVOIR STORAGE. a. Colonel Powers stated that the planning studies were at a point where reservoir storage capacities must be related to basin problems. The basin problems require that a study be made of the multiple-purposes for which reservoir storage can be used. On the problem side of the relationship are water requirements, and on the other are water yields from the projects to meet the water requirements. Colonel Powers indicated that the next paper, by Mr. George Mondrillo, dealt with a method, developed in Philadelphia District Office, for estimating the gross yield to be expected from the reservoir storage planned at the sites under consideration.

b. In his presentation Mr. Mondrillo said that the relation of water yield to reservoir storage is normally determined by analysis of mass curves of runoff. Such analyses have been completed for a wide range of areas in the basin and their results were expressed in the form of flow-storage curves for specific stream-gaging stations. The Philadelphia District Office of the Corps has developed a generalized method to show the relationship of flow and storage which can be applied to ungaged streams, or streams having

insufficient record, for mass curve analysis. The new method uses drainage area only and permits rapid computation of water yields. Mr. Mondrillo's full report is appendix H hereto.

c. Mr. Ackroyd asked what frequency was associated with the flows obtained from the curves. Mr. Mondrillo replied that no attempt was made to relate reservoir yields to frequency. The ultimate flows are the averages of the mean monthly flows for a 32-year period of record and may be exceeded 50% of the time. The reservoir yields shown in his paper are the assured minimum flows that could have been maintained at all times throughout the history of flow from 1922 to 1954. The percent of time that the natural flow would have been below the indicated reservoir yield may be obtained by reference to the flow-duration curves of mean-monthly flow.

d. Mr. Shanklin remarked that Mr. Mondrillo indicated the reservoirs were designed so as to be effective through the drought of 1930-1932, the driest period in 76 years of record. He asked whether it was economically sound engineering to limit development yield to an unusually dry period inasmuch as the next driest period would require only one third as much storage. He said that in flood control the evaluation is made on the basis of average annual damage and believed that an annual basis should be applied to low flow control. Colonel Powers remarked that the extreme fluctuation over the longest period of record must be taken into account in order to assure the availability of at least the minimum required flow. He indicated that planning work must be done with whatever data are available in order to determine or estimate conditions which must be provided for in the future.

(The discussion which followed Mr. Shanklin's comment did not treat the matters as fully as they may have been. The Chairman therefore takes this opportunity to present additional discussion for the benefit of the Committee Members.

(1) Storages for water supply have been allocated by a procedure designed to provide optimum yields. This procedure was described by Mr. Morgan at the fourth meeting of the Committee (see Appendix R of minutes for that meeting). The yields indicated by one method as being theoretically possible from such storage would meet minimum requirements through the most severe drought of record. However, it is recognized that higher yields may be obtained from the same storage if there is a willingness to accept the risk of inconvenience and damage associated with prolonged droughts.

(2) For both flood control and water supply the Corps plans for the worst condition of record. It is true that flood control benefits are evaluated on the basis of the annual damages prevented; however, not only is flood control storage planned to contain the highest flood of record, or the maximum justifiable portion thereof, but the spillways are designed to withstand the onslaught of a greater flood, one whose probability of occurrence is far less. Comprehensive planning requires equal consideration of both high and low flow extremes.)



e. In answer to Mr. Ackroyd's question as to whether storage as discussed referred to reservoir or channel storage, Mr. Mondrillo replied that it was reservoir storage as indicated on Plate 4. Normally, if one had stream flow data for a particular site, any storage value could be picked and the yield for that storage could be determined from an analysis of the mass curve. In the generalized method presented here, the mass curve analysis has already been done. With this method one only needs to know the drainage area and the project storage to obtain an estimate of the yield.

f. Mr. Ackroyd, referring to Plate 1 which shows a curve for the flow-storage relationship at Trenton, asked if there was a proposed project at Trenton. Mr. Mondrillo said that there was no proposed project at Trenton. He explained that the curve was included to show the relative shape and magnitude with respect to relations at the other main stem stations and to demonstrate its conformity to the dimensionless curves for smaller areas as indicated in Plate 2.

12. BACKGROUND FOR PROJECTING WATER REQUIREMENTS. The Chairman remarked that in order to appreciate the problems which need to be faced in projecting water requirements, assignments were made to several Federal members to make presentations regarding the collection of data on past uses and on the methods which may be used for estimating future needs. He was hopeful that the information in the presentations which followed would be sound bases for taking the next steps for establishing the water requirements which the comprehensive plan must aim to meet. It was recognized that there are various methods or bases for projecting water requirements. It was also recognized that the problem at hand was difficult due to the complex development of the basin. The Chairman indicated that he was still open minded as to which method, or combination of methods, should be used for projecting water requirements for the purpose of this report.

13. MUNICIPAL AND INDUSTRIAL WATER USE, AND METHODS USED TO OBTAIN DATA THEREON. a. Mr. De Falco stated that the Public Health Service had been given the responsibility for the preparation of an inventory of municipal and industrial water use. He identified the sources of data on municipal use and the special conditions under which data on industrial use were made available. Mr. De Falco's presentation is given in full in Appendix I hereto.

b. In reply to Mr. Ford's question as to whether the daily use of 1.8 billion gallons/day for New York City was as of the present day or a future requirement, Mr. De Falco stated that the quoted figure applied to Sub-region A (as defined in OBE's Economic Base Survey) which covered the New York metropolitan area and not merely New York City, and further, that the figure was based on data for 1955 from various sources.



c. Responding to a query from Mr. Baxter as to whether the inventory will also be compiled so as to show use by portions of states, Mr. De Falco indicated that arrangements had been made to make the presentation by states as well as by sub-regions so that each state may have data pertaining to it for its report. Mr. Klashman remarked that the PHS representatives were working on this phase with state representatives and the basic data were that of the states.

d. Mr. Baxter asked whether figures on industrial use were as measured and whether all the need was for potable water. The reply by Mr. De Falco was to the effect that the figures were based on measured use and that whether the water need be potable depended upon its specific use in industry. About 70% of the water used by industry is for cooling purposes and, therefore, need not be potable; whereas about 20% is for processing wherein various degrees of quality are either required or permissible depending upon the process in question.

14. A BRIEF SUMMARY OF WATER REQUIREMENTS FOR IRRIGATION AND RURAL DOMESTIC USE IN THE DELAWARE RIVER BASIN AREA. a. Mr. Gail W. Eley informed the conferees that between the years 1955 and 1975 the total basin water needs for agricultural and rural use are expected to increase by more than three-fold. The increase will be caused by urban and suburban development, industrial expansion and highway encroachment upon present agricultural lands, and the loss of which will necessitate more intense farming and increased production, which in turn will necessitate irrigation. After describing the methods and sources used to determine and project water needed for irrigation, Mr. Eley stated that available water is not and will not be sufficient for irrigation purposes, and that additional sources need to be developed to offset the deficiency. Mr. Eley's full report is Appendix J hereto.

b. Referring to figure 3 used in the presentation, Mr. Baxter commented that this was the first time that there had been presented to the Committee a curve which shows a decline in the potential need for a specific use of water in the future. Mr. Eley explained that this reflected the loss of irrigable acreage to suburban development. Mr. Baxter then raised the question as to whether irrigation should be permitted in the event adjacent areas became suburban and both depend upon the same source for water. Mr. Eley replied that restrictions on water use are being considered in some of the northeastern states and that in some instances legislation bearing on water rights is being prepared. In view of this, Mr. Eley indicated he had assumed that in the future there would be some restrictions on water use in the basin and this was reflected in the curve which shows a decline for agricultural use.

c. Mr. Peterson asked if the water deficiency areas to be supplied by the Delaware included Dutchess County and Long Island. Mr. Eley replied that the New York counties were excluded, but that the counties of North Jersey, the counties of coastal Jersey to the Cape and the areas of the counties of Delaware which are outside the basin were included.

d. Mr. Shanklin commented that many rural areas do not need supplies from surface sources, and that in his opinion two-thirds of the rural population will always be dependent upon private wells. He suggested that the Soil Conservation Service and the Public Health Service must take this aspect into consideration.

15. ILLUSTRATIVE METHOD FOR DETERMINATION OF MUNICIPAL AND INDUSTRIAL WATER NEEDS. Mr. David E. Donley, of the Corps' staff, stated that the determination of future water needs constitutes a vital phase of the comprehensive water resources investigation in the Delaware River basin, and that various agencies have projected, or are currently projecting, portions of such needs. He described a method for projecting municipal and industrial water needs and said he wished to focus interest on that phase of the comprehensive study. Mr. Donley's full report is Appendix K hereto.

16. ESTIMATES OF WATER DEMANDS BY STATES AND CITIES.

a. The Chairman stated that at the work group session of the Committee at the previous meeting held 26 June in Honesdale, he had requested the State and City members of the Committee to furnish him and the other members, by 1 September, their then current estimates of projected water demands and an indication of their projected plans for meeting those demands. The demands were to be indicated, to the extent that readily available information would permit, by general location, quantity, uses and time. Colonel Powers pointed out that it is to be understood that the estimates are subject to refinement and revision as the States and their sub-divisions proceed with their own works in water resource development. He said very serious attempts will be made to arrive, by January 1959, at demand figures which will be utilized in establishing the plan.

b. State of New York. Mr. Peterson had to leave before this subject came up for consideration, and at his request the Chairman read a letter, dated 3 September, which stated that 37 communities of New York State currently depend on the surface waters of the Delaware basin. The combined population of these communities, according to the 1950 census was 57,663. Their average total daily use in recent years has been 4-1/2 mgd. The estimates of needs to the year 2010 were shown in an attachment to the letter. Copies of Mr. Peterson's letter were distributed to the members at the meeting.

c. City of Philadelphia. Mr. Baxter addressed a letter to Colonel Powers on 30 July 1958, and distributed copies of it to the other members, in which he indicated the presently estimated needs of Philadelphia for the next 40 to 50 years. The maximum day requirement for raw water for the year 1980 is estimated as 620 mgd, which reflects a 24% allowance for the peak day. The water demand for the year 2010 was estimated as 670 mgd for the maximum day. Mr. Baxter supplemented the content of his letter by remarking that the officials of Philadelphia want to feel that any time the City wants to go upstream, no matter how far, for water from the Delaware, that there will be water there for the City. He also expressed concern with regard to one point centered on the diversions by New York City, but stressed that an expression of concern by Philadelphia did not necessarily mean it was differing with regard to releases. Philadelphia is aware that a court decree fixes the quantities of water to be diverted and to be released; however, while all the works for making diversions had not yet been built, it is a fact, Mr. Baxter remarked, that the releases as planned in terms of quantities could not be met. While he admitted reluctance to state so, he did make the point that Philadelphia was better off in 1957, because of the releases made, than it would have been under natural stream flow conditions. Nevertheless, the flows which were to be expected did not materialize. Also, he envisions that releases in excess of those required by the basic formula will gradually get smaller as New York City's demands get larger, and therefore, it appeared to him that any plans for the river, looking ahead to the year 2010 must recognize that any existing uses or diversions are not sacrosanct and are, therefore, subject to review in the long range report. In response to a question by Mr. Ross, Mr. Baxter said that his figures were for the City only, and that they did not include those for suburban areas, which were covered by Mr. Goddard's report. Mr. Goddard asked if the quality couldn't be improved, to which Mr. Baxter replied that when one quality characteristic goes up, another goes down. As an example, he stated that the Schuylkill River was black before the state and federal governments removed culm desposits six or seven years ago. Now it is clean, but supports a lush growth of algae. Then, too, the water is harder than it was in 1920; the cause is not known, but it could be due to new exposures of limestone.

d. State of New Jersey. Mr. George R. Shanklin referred to Mr. Bontempo's letter dated 2 September 1958 which was addressed to Colonel Powers and copies of which were distributed to the Committee members. The letter contained a preliminary report on the projected public water supply requirements for the State of New Jersey. Mr. Shanklin discussed the contents of the letter and described the bases upon which the estimates of water requirements were made.

e. City of New York. Mr. Ford stated that the Board of Water Supply is the only agency of New York City which plans for the water supply needs in that city. With the exception of cooperation with other agencies such as the State Water Power and Control Commission and the Water Pollution Control Board, which issues permits for taking waters under certain conditions, the Board of Water Supply has been planning to meet the water requirements of New York City for more than half a century. Under the latest (7 June 1954) decree of the U. S. Supreme Court, New York City is permitted to divert 490 mgd from the Neversink and Pepacton Reservoirs, and on the completion of the Cannonsville Reservoir, on the West Branch, an additional 310 mgd. Mr. Ford then discussed the contents of his letter of 20 August 1958 in which he gave the Chairman the City's estimated requirements. (Copies of that letter were furnished to the members). After this discussion, Mr. Ford commented on the City's development of Upper Delaware basin. The City is presently progressing to the last stage of this development. The 44-mile tunnel through which the 310 mgd diversion will be made from the Cannonsville project to Rondout Reservoir, is about 40% complete. Its cost is about \$94,000,000. The West Branch project, at Cannonsville, is expected to be completed by 1963 and in operation by 1965.

f. Commonwealth of Pennsylvania. In a letter, dated 11 September 1958, addressed to the Chairman, and copies of which were furnished to the members, Mr. Goddard presented estimates of water requirements, at 10-year intervals for the period 1960-2010, for the Pennsylvania section of the Delaware River basin. Mr. Goddard discussed the contents of his letter and then commented on the study of water needs and water availability being made in the Brandywine basin area. The consulting engineers were expected to submit a report on their findings to the Commonwealth in October. It is hoped that on the basis of that report a better estimate for industrial and agricultural uses of water can be obtained. Also on the basis of that report, it is expected that authority to build several reservoirs on the upstream portion of the Brandywine basin will be requested. The Lukens Steel Corporation has a \$3,000,000 expansion program under way, and needs an additional 5,000,000 gallons of water per day. In order to obtain this quantity the corporation will either have to build a reservoir or combine its effort with some other group to have one built. Pennsylvania's aim would be to build a multiple-purpose reservoir, possibly in cooperation with the State of Delaware. In the matter of trying to upgrade waters in the Schuylkill River, Mr. Goddard remarked that some consideration should be given to neutralizing the acid condition of the east main branch. The Department of Forests and Waters is studying two reservoir projects proposed by the Soil Conservation Service to determine whether they can be enlarged to supply water with a view to ameliorating this condition. Referring to a comment made at the work group session to the effect that some of the reservoir sites in New Jersey being studied for project possibilities are not acceptable due to local resistance to such developments, Mr. Goddard remarked, in essence, that



the Corps should produce the best plan that is now feasible based solely on engineering considerations, and if necessary, the plan could be amended later to make it acceptable to the local interests concerned; but at this time, public opinions should not be permitted to enter into the planning.

g. State of Delaware. Dr. Kaplovsky stated that the State of Delaware Water Resources Committee had submitted its estimates of future water needs to the District Engineer by letter dated 28 August, and that he wished to review certain portions of that letter without referring to detail. (Copies of the letter were furnished to the Committee members.) Delaware, because of its size, geographic location, industries and land uses, has unique situations relative to water that differ from those of the larger states. It has had no central organization that could speak on water resources, consequently its major task was one of intrastate coordination. Dr. Kaplovsky reported that a complete inventory was made of industrial water use, irrigation use and municipal water use. All water requirements for industrial cooling and steam generation from surface sources were omitted in the present use totals. A major portion of those waters is brackish; however, approximately 15% is taken from the fresh water streams. The projected needs for the State for the year 2010, excluding industrial cooling and stream generation requirements, total approximately 1400 mgd. Assuming that all surface sources within the State were developed to the degree indicated in the State's report and that an estimated 418 mgd of ground water safe yield were readily available, the State would still receive less than half of its total projected needs for the year 2010. The only other source of water available to the State of Delaware is the Delaware River.

17. SUGGESTIONS OF TOPICS FOR CONSIDERATION AT THE NEXT MEETING.

a. The Chairman remarked that according to the present schedule the report is to be completed by December 1959. The efforts of the Corps' staff and work group composed of representatives of other agencies are presently directed toward evaluating the seven reservoir plans being studied. On the basis of these evaluations, it is expected that by January a scheme will be selected which will contain the elements of the final plan to be studied in detail and form the basis of the comprehensive plan for the basin. It is proposed to present and discuss the selected scheme of reservoirs at the next meeting of the Committee.

b. The next topic discussed was the new Fish and Wildlife Coordination Act, Public Law 85-624, which was approved 12 August 1958. The new law amends the Fish and Wildlife Act of 10 March 1934 and, in part, supersedes Public Law 79-732 of 1946. Its purpose is to set up fish and wildlife as a project purpose in planning water resource development. The Chairman remarked that the new law probably would not affect the physical recommendations which will be made in the final report but that it could affect the degree of Federal participation and

costs thereof. Mr. Gascoyne offered to obtain copies of the presentations on P.L.85-624 made on 11 September 1958 by Mr. Carter Page and Mr. McBroom, to summarize them for presentation at the next meeting of the Committee, and to send a copy of each summary to the members representing the cities and states prior to the next meeting. Mr. Gascoyne also remarked regarding the need for the representatives of the Federal agencies to reach a basis of agreement relative to operating under P.L.85-624 before the states get involved. The Chairman accepted Mr. Gascoyne's offer to prepare summaries of the papers on P.L.85-624 and requested that the distribution to members be made early enough to permit the appropriate state agencies to prepare comments on his paper.

c. The Chairman proposed that the next meeting of the Committee be held in Philadelphia in mid-January.

d. In response to a question by Mr. Baxter, the Chairman said that a paper on navigation would be presented at some future meeting.

e. Mr. Morgan suggested that the Public Health Service present at the next meeting a report on the multiple use of stored water. Mr. Klashman said that the Public Health Service has started work on such a report but had not yet formed a policy. The Public Health Service would like to have the States' views on recreational use of impoundments intended for water supply.

18. REMARKS BY COLONEL CLARK. Colonel Allen F. Clark, Jr., Division Engineer, North Pacific Division, formerly District Engineer, Philadelphia, and Chairman of this Committee, commented briefly on the comprehensive report on the Columbia River which was completed recently. In comparing the Columbia basin with the Delaware, he remarked that there was an abundance of water and power potential in the former. He cautioned the members not to underestimate the time required to put the report in its final form after the studies and evaluations are completed.



W. F. POWERS  
Colonel, CE  
Chairman

\*MINUTES OF THE SEVENTH MEETING  
OF THE  
DELAWARE BASIN SURVEY COORDINATING COMMITTEE  
HELD 22-23 JANUARY 1959  
IN PHILADELPHIA, PA.

1. OPENING REMARKS. The Committee was convened in the Auditorium of the Academy of Natural Sciences on 22 January 1959 by Colonel W. F. Powers, Chairman. Colonel Powers expressed appreciation for the use of the Auditorium to Dr. H. Radcliffe Roberts, Director of the Academy.

2. ATTENDANCE AND INTRODUCTIONS. a. The following members were in attendance:

Mr. Richard A. Ackroyd for Mr. S. L. Taylor,  
Department of Commerce  
Mr. Samuel S. Baxter, City of Philadelphia  
Mr. David S. Davies, for Mr. Salvatore A. Bontempo <sup>1/</sup>,  
State of New Jersey  
Mr. Arthur C. Ford, City of New York  
Mr. D. R. Gascoyne, Department of the Interior  
Mr. Maurice K. Goddard, Commonwealth of Pennsylvania  
Dr. A. Joel Kaplovsky for Mr. Richard A. Haber,  
State of Delaware  
Mr. Sylvan C. Martin, Dept. of Health, Education & Welfare  
Mr. Ronald B. Peterson, State of New York  
Mr. John H. Spellman, Federal Power Commission  
Mr. Alvin C. Watson, Department of Agriculture

b. Colonel Powers introduced Colonel George B. Sumner, District Engineer, Washington District; Mr. Richard A. Hertzler, Office of Civil Functions, Office of the Assistant Secretary of the Army; Mr. Edwin W. Landenberger of the Office of the Chief of Engineers, and Mr. Burnham H. Dodge of the North Atlantic Division Office. The members introduced the various representatives from their respective agencies participating in the survey. Colonel Allen F. Clark, Jr., Division Engineer, North Pacific Division, formerly District Engineer, Philadelphia, and Chairman of this Committee, attended the meeting on 23 January.

c. The names of the 122 persons who registered and attended the meeting are listed in Appendix A hereto.

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<sup>1/</sup> Mr. Bontempo attended the work group meeting which preceded the sessions covered by these minutes.

\* See minutes of next meeting for corrections.

3. MINUTES OF PREVIOUS MEETING. a. The following modifications were requested in the minutes of the sixth meeting held in New York City on 18-19 September 1958.

(1) On page 4, paragraph 5b, line 5, delete "Advisory Committee" and insert in lieu thereof "Delaware River Basin Research Corporation, Incorporated."

(2) On page 8, line 4, delete the words within the parenthesis, "those needed beyond 2010", and insert in lieu thereof "those needed between 1980 and 2010."

b. The minutes were approved subject to the above modifications.

4. SIGNIFICANCE OF PUBLIC LAW 85-624. a. Mr. D. R. Gascoyne presented a paper on the significance of the Fish and Wildlife Coordination Act, Public Law 85-624, which was enacted 12 August 1958 to provide for more effective integration of a fish and wildlife conservation program with Federal water resources developments. Copies of Mr. Gascoyne's paper were distributed to the members about a month prior to the meeting.

b. Mr. Ford asked if a non-Federal organization, which built a dam across a major stream, would be provided with Federal assistance in financing facilities for fish and wildlife. As of the present time, Mr. Gascoyne did not see anything specifically directed toward such provision. The constructing agency, however, would be expected to provide for mitigation of any damages to the resources, and the cost of such provisions would be a part of the project cost. When questioned by Mr. L. G. Duck as to whether the provision of such mitigation was applicable only to projects built by the Federal government, Mr. Gascoyne indicated that it applies to any public or private agency as long as the project is under Federal license or permit.

c. Mr. Ford remarked that in a number of New York City projects it would be feasible to take care of fish and wildlife, but that there is no provision in the law for providing the additional funds required. Mr. Marston indicated that Federal aid funds may be used in a case of a municipal project development.

5. SIGNIFICANCE OF PUBLIC LAW 85-500. a. Mr. Edwin W. Landenberger discussed the Water Supply Act of 1958, Public Law 85-500, which was enacted 3 July 1958. This act recognizes a joint Federal, state and local interest in municipal and industrial water supply for meeting present and future needs where such supply can be developed by reservoir projects undertaken by the Corps of Engineers or the Bureau of Reclamation. Mr. Landenberger's full presentation is Appendix B hereto.



6. POLICIES GOVERNING THE COMPATIBLE USE OF MULTI-PURPOSE RESERVOIRS. a. Mr. Davies, substituting for Mr. Bontempo, read a paper explaining the legislation known as the "New Jersey Water Supply Law of 1958", and the companion "Water Bond Act" which were enacted to assure maximum utilization of the state's water resources. The full presentation is Appendix C hereto.

b. Mr. M. K. Goddard presented Pennsylvania's policy in regard to the joint use of reservoirs for water supply and recreation, and told how that policy differentiated between existing reservoirs developed by water purveyors for the sole purpose of water supply, and proposed reservoirs to be constructed with public funds, the uses of which are set forth in advance. Mr. Goddard's full presentation is Appendix D hereto.

c. Dr. A. Joel Kaplovsky said that since the State of Delaware does not have a water resources planning or control unit various state agencies were requested to submit statements of their policy or thinking, in regard to multiple-purpose use of reservoirs. Dr. Kaplovsky's presentation consisted of abstracts and condensations of such statements. The full presentation is Appendix E hereto.

d. Mr. R. D. Peterson indicated in his presentation that the State of New York has been cognizant of the multitude of problems inherent in the wise use and conservation of its water resources, and that under state law the determination of incompatible uses of water has practically become automatic. Mr. Peterson's full presentation is Appendix F hereto.

e. Mr. S. C. Martin of the U. S. Public Health Service presented a summary of policies and practices governing the use of multi-purpose reservoirs in other parts of the country. The presentation is Appendix G hereto.

7. GROSS AND NET WATER DEMANDS. Mr. Russell Morgan, Chief of the Valley Report Group, presented a paper on water needs and their relation to storage at projects for the control of surface run-off. The full text of this presentation was distributed (with a memorandum on 5 February) to the members and representatives of participating agencies for review and comment. Appendix H hereto is a condensed version of the presentation.

8. SELECTION OF RESERVOIR PLAN. Colonel W. F. Powers presented the basic plan for control and utilization of the waters of the Delaware River basin. The full text of this paper was distributed (with a memorandum of 5 February) to the members and representatives of participating agencies for review and comment. Appendix I hereto is a condensed version of the presentation.

9. STATEMENT ON THE STATUS OF THE WORK BY THE VARIOUS AGENCIES AND GENERAL COMMENTS ON THE PROCEDURES BEING FOLLOWED IN THE SURVEY AS A WHOLE. a. Department of Agriculture. Mr. Watson reported that sections of the report by his Department are in various stages of completion and it is expected that the report can be consolidated in the next five months or so. The report on Irrigation and Rural Water Use is in the review stage. By the next meeting it is expected that more concrete information will be available as to where the upstream auxiliary reservoirs will fit into Phases I and II of the basic plan for development. Mr. Watson said that a small watershed program develops improvements of the land and management resources through projects undertaken by the various levels of government with the support of landowners and operators in the watersheds. The objectives are to provide the fullest production management to get the maximum economic return therefrom, and to provide the fullest enjoyment thereof. Some watershed improvement will prove highly significant to the national agricultural segment of society. By the years 2000 and 2010 agricultural production will probably be four times what it is now, and the values of commodities produced will be enormous. Approximately 65% to 70% of all raw materials used in industry and commerce come from agricultural sources. The dependence of the city on the country is pretty well known and recognized, but less understood, is the dependence of the country on the city. Agriculture, as a whole, is more important to water development than is artificially supplied water to agriculture. In one year the farmers in Pennsylvania spent over one million dollars for water control projects and practices, such as diversion, ditches, watershed protection and other measures, which illustrates the concern of the individual landowner and operator for controlling water on his own land. Mr. Watson said that the number of sites, previously reported as being from 340 to 390 at various stages of the study, has been considerably reduced through the studies of the Joint Work Group. Currently about 43 can be justified from a flood control point of view. Of the 43, 22 are already in Public Law 566 programs either in the preliminary stage or in the approved for construction stage. For the 43 sites which can be justified, no determinations have been made in respect to irrigation, fish and wildlife, municipal and industrial use, recreation needs and other uses. With respect to the procedures being used in the comprehensive survey Mr. Watson remarked that they were satisfactory, and that the Corps of Engineers and the other agencies, by and large, were doing a good job under processes he considered to be reasonable. He had no objections to the procedures being used, but felt that some alterations in procedures would be made in the light of the experience gained thus far if a new start were to be made on another such survey. Mr. Watson concluded his presentation with a discussion of a map showing the locations of watersheds for which programs under P.L. 566 have been established or are being studied. The map is attached hereto as Appendix J.

b. Department of the Interior. Mr. D. R. Gascoyne reported on the status of the work in the agencies in his Department, and made general comments on the procedures being followed in the survey as a whole. The presentation is Appendix K hereto.

c. Department of Commerce. Mr. Richard Ackroyd had nothing new to report on the work of the Department of Commerce, inasmuch as OBE had finished its assignment, and stated that he had no objections to the procedures being followed in the survey as a whole.

d. Department of Health, Education & Welfare. Mr. S. C. Martin presented a statement on the status of the work of the Public Health Service and commented on the procedures being followed in the survey as a whole. Mr. Martin's presentation is Appendix L hereto.

e. Federal Power Commission. Mr. John H. Spellman reported the Federal Power Commission was making significant progress in its study which is directed into three general areas, namely (1) power values, (2) preparation of a power market survey, and (3) collaboration with the Corps in studies of ways and means of developing the power values in any particular project. He re-referred to the preliminary report, on power supply and requirements for the area served by Pennsylvania, Maryland, New Jersey and Delaware interconnection, which he presented at past meetings. Such a survey will serve two purposes. It will give a comprehensive picture of power supply and will be the basis used for developing the needs for meeting the future loads, which were previously estimated as 12 to 15 million KW greater by 1975, than the present load of 12 million KW. Since the last meeting these estimates have been refined. The power market survey is proceeding according to schedule. The agency has also continued to develop power values. The values used to date are preliminary and need to be refined. The Federal Power Commission will continue to work with the Corps on the refinements of upstream storage reservoirs as well as on sites presented in the basic plan. Consideration is being given to the feasibility of pumped-storage power projects as well as to the normal type of hydropower developments. In view of the part that private utility companies would need to play in a pumped-storage power development, the utility companies operating in the basin have been invited to participate in the power studies. As a result, the utility companies have appointed five representatives to work with the power work group, which is composed of Federal Power Commission and Corps of Engineers personnel. Mr. Spellman, who is chairman of the work group, introduced representatives of the power companies, who are: (1) Mr. Charles A. Carpenter of the Pennsylvania Power & Light Company, (2) Dr. M. D. Hooven of Public Service Electric & Gas Corporation, (3) Mr. E. S. Loane of General



Public Utilities Corporation, (4) Mr. Richard A. Lane of Philadelphia Electric Company and (5) Mr. L. E. Merrow of Orange & Rockland Utilities, Inc. At its first meeting held the preceding week, the work group concluded that it could find solutions to the problems within the time limit, about 1 June. Mr. Spellman said that at the next meeting he would be able to give more information about the particular projects being considered - Tobyhanna, Shohola Falls, Tocks Island, Basher Kill and Flat Brook. He indicated that the Federal Power Commission is satisfied with the consideration it is being given in the comprehensive survey. He drew attention to the fact that the Federal Power Commission, under the Federal Power Commission Act, gives consideration not only to the subject of hydropower development, but also to the ways power could be developed compatible with other uses of water.

10. C. of E. - SCS Joint Work Group. Mr. Charles C. McNamara, of the Corps of Engineers, reported on the status of work of the Joint Work Group. The presentation is Appendix M hereto.

11. STATUS OF REPORT PREPARED BY THE U. S. GEOLOGICAL SURVEY.

a. Mr. Martin inquired whether the report on general geology, ground water, sedimentation and general hydrology, prepared by the USGS, was distributed for review and comment. The Chairman indicated that it was the final version of the USGS report and that it was distributed for use. To a query by Mr. Ferguson, representing the USGS, as to how the decision was made that the report was the final version and that comments or possible revisions were not requested, the Chairman stated that when the report was delivered to him by Mr. Parker, he stated that it represented the completed work of the USGS, that it had been approved by the Director, and that he, Mr. Parker, had no authority to make any changes in it. Mr. Ferguson expressed regret that there had been a misunderstanding and clarified the intent of the USGS. He stated that the report was a draft and, as such, was approved for transmittal to the Corps for the same treatment, involving distribution, review and transmittal of comments, as was given drafts of reports of other agencies. In view of this clarification and desire of the USGS, the Chairman notified the representatives of the participating agencies present to consider the USGS report to be a draft, to review it and submit comments thereon as soon as possible so that the USGS could make such revisions as may be appropriate.

b. In the event that the USGS receives a comment or a request for a change in which it does not or cannot concur, the Chairman requested the USGS to consult with the agency making such a comment or request. If the matter cannot be resolved by such consultation, the Chairman indicated that the agency making the comment or request could express its view in its own report where appropriate. He announced that this procedure could be applied to all reports distributed for review. Mr. Larson asked that further consideration be given to the method for resolution of conflicts. He indicated that the SCS did not



agree with the figures on irrigation presented in the USGS report, but he did not wish to include a statement regarding such a conflict in the report by the Department of Agriculture if the matter could not be resolved by discussion. Mr. Martin stated that he, too, had no desire to put in the report by the Public Health Service a statement showing where his agency differed with the USGS on figures related to municipal and industrial water use. The Chairman reviewed briefly the basic cause for the arising of the problem under discussion, it being the inclusion in the USGS report of presentations on water uses which had been assigned to the Department of Agriculture and the Public Health Service. In view of the complexity of the problem and the probable length of time that would be required to resolve it, Colonel Powers announced that he would call a meeting of an ad hoc committee composed of representatives of the Departments concerned for the purpose of resolving the matter.

12. COMMENTS BY THE STATE AND CITY MEMBERS ON THE PROCEDURES USED IN AND THE PROGRESS OF THE PLANNING. a. City of Philadelphia. Mr. Baxter said that the City's part in the survey so far had been very small and that he enjoyed being on the Committee. From the City's standpoint progress has been satisfactory.

b. City of New York. Mr. Ford said that he had found the study and the meetings to be a rewarding and stimulating experience; he felt that a great deal had been learned from the association with the Committee, and that he was satisfied with the progress made in the study.

c. State of Delaware. Dr. Kaplovsky stated that Delaware representatives had presented constructive criticism on every report draft sent to them for review and comment. They tried to make their reviews with an unbiased viewpoint and the comments represented the thinking of all the agencies in the state. Dr. Kaplovsky commented that in the various reports, several agencies used different county groupings for sub-dividing the basin, and that the work of reviewing the reports would have been expedited if the studies had been done on a county by county basis.

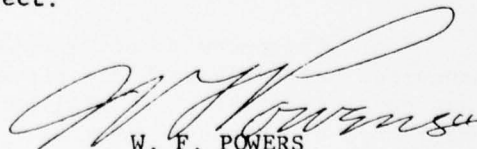
d. Commonwealth of Pennsylvania. Mr. Goddard stated he concurred basically with the procedures followed, that a fine job was done, and that there will be a great deal more to be done and many more decisions to be made. He described briefly the SCS-State plan of development for the Brandywine basin and offered to send any interested member a copy of the report thereon. Mr. Goddard said that he felt there was no conflict between the plan and the comprehensive survey of the Delaware basin. In view of the water supply features of the Brandywine plan he expressed the hope of getting the cooperation and financial participation of the State of Delaware and the City of Wilmington in the development of the plan. He expressed hope that Mr. Spellman and his

power work group could make decisions soon on the Basher Kill and Tocks Island project; and that the Corps would make one soon on the Tohickon project. The Department of Forests and Waters is under great pressure to create a string of parks around the City of Philadelphia, and Mr. Goddard felt that the Tohickon site would fit into such a plan. Mr. Spellman remarked that a decision could not be given before May. Colonel Powers remarked that he would like to have a great deal more time for project evaluations, but that Mr. Morgan should have the decision by May 1, or at the latest June 1, in order to get it in the report. Colonel Powers said that with the time limit set, he may not be able to evaluate all of the projects in great detail and that it has been suggested that more time be spent on those projects likely to be constructed within the next 20 years.

e. State of New Jersey. Mr. Davies complimented the Corps on the progress made. He reported that New Jersey had started a wide survey of industrial water use and future water demands. In this connection the reports presented earlier at this meeting by Colonel Powers and Mr. Morgan will be studied carefully. He will welcome any suggestions regarding such a survey, and accepted Mr. Morgan's offer of an opportunity to inspect the detailed information available in this office. Colonel Powers said he had repeatedly announced that the methods used in the studies and the sources of data are available to everyone, although there are sometimes working papers which are not for publication.

13. STATUS OF WORK BY THE CORPS OF ENGINEERS. Mr. Russell Morgan, Chief of the Valley Report Group, reported on the status of the work being done by the Corps of Engineers in the comprehensive study. The presentation is Appendix N hereto.

14. SUMMARY. After a brief discussion as to the date and the place of the next meeting, Colonel Powers announced that it will be held in the Pocono region during the latter part of May. Regarding the actual work, Colonel Powers said that compliments were not necessary, what he wants to know is whether the members feel that progress is being made in the right direction to obtain a comprehensive plan. He requested that anyone not in agreement with the procedures being followed, notify him to that effect.



W. F. POWERS  
Colonel, CE  
District Engineer and  
Chairman, Delaware Basin Survey  
Coordinating Committee

\*MINUTES OF THE EIGHTH MEETING  
OF THE  
DELAWARE BASIN SURVEY COORDINATING COMMITTEE  
HELD 13-14 MAY 1959  
AT LAKE HARMONY, PENNA.

1. ATTENDANCE. a. The Committee was convened in the meeting room of Split Rock Lodge on 13 May 1959 by Lt. Colonel Frank A. Gerig, Jr., Chairman. The following members were in attendance:

Mr. Mark Abelson, Dept. of the Interior  
Mr. Richard A. Ackroyd for Mr. S. L. Taylor, Dept. of Commerce  
Mr. Samuel S. Baxter, City of Philadelphia  
Mr. David S. Davies for Mr. S. A. Bontempo, State of New Jersey  
Mr. Arthur C. Ford, City of New York  
Mr. Maurice K. Goddard, Commonwealth of Pennsylvania  
Dr. A. Joel Kaplovsky for Mr. R. A. Haber, State of Delaware  
Mr. Sylvan C. Martin, Dept. of Health, Education and Welfare  
Mr. Ronald B. Peterson, State of New York  
Mr. John H. Spellman, Federal Power Commission  
Mr. Alvin C. Watson, Dept. of Agriculture

b. Mr. Mark Abelson represented the Department of the Interior in lieu of Mr. D. R. Gascoyne who has been assigned to the Office of the Commissioner, U. S. Fish & Wildlife Service, Washington, D. C.

c. The names of the 131 persons who registered and attended the meeting are listed in Appendix A hereto.

2. OPENING REMARKS AND INTRODUCTIONS. a. Colonel Gerig announced that he had been designated by the Chief of Engineers as the Acting District Engineer, Philadelphia Engineer District, and the Acting Chairman of this Committee. He also informed the Committee that Colonel W. F. Powers, former Chairman and District Engineer, had retired from the Army and was now associated with the Lincoln Center for Performing Arts, Inc., as the Deputy Executive Director for Construction.

b. Mr. Spellman made a motion, which was seconded by Mr. Goddard, to the effect that the Chairman address a letter to Colonel Powers expressing the Committee's appreciation for his leadership of the Committee and his services in developing a plan for the basin. There was a unanimous expression of concurrence in the motion, and Colonel Gerig indicated that he would take appropriate action.

c. The Committee concurred in the suggestion of Mr. Martin that a letter of appreciation also be sent to Mr. Gascoyne for his contribution to the work of the Committee. The Chairman stated that he would take action in accordance with the Members' desire.

\* See minutes of next meeting for corrections.

d. The Chairman introduced Messrs. Burnham H. Dodge, James R. Johnston and George M. Tapley of the North Atlantic Division and Mr. Richard D. Murray, a member of the staff of the Board of Engineers for Rivers and Harbors.

3. COMMENTS ON MINUTES OF PREVIOUS MEETING. a. Colonel Gerig stated that at the seventh meeting a request was made for a determination as to whether parties, other than governmental agencies, were included in the term "local interests" as used in the Water Supply Act of 1958, Public Law 85-500. In the interim it was determined from the Office of the Chief of Engineers that the term as used in the act is considered to include non-governmental organizations, examples of which are industries and private water companies.

b. There being no other additions, nor any corrections, the minutes were approved.

4. REPORT ON THE MEETING OF THE AD HOC COMMITTEE ON THE SCOPE OF THE USGS REPORT. Mr. Russell Morgan, of the Corps of Engineers, reported on the ad hoc committee meeting which was held 6 February 1959 in the office of the District Engineer. It was the sense of the committee that the scope of the USGS report should conform to that outlined in the original assignment, namely, to a coverage of ground-water and sedimentation. The full presentation is Appendix B hereto.

5. STATUS OF APPENDICES. Mr. Vladimir V. Lisovitch, of the Corps of Engineers, reported that two appendices to the comprehensive survey report have been completed and distributed in final form. Two others were distributed in draft form for review, and comments thereon have been forwarded to the author agencies for consideration. In addition parts of a number of appendices were distributed in draft form and the resultant comments have been forwarded to the author agencies for consideration. Mr. Lisovitch's full presentation is Appendix C hereto.

b. Colonel Gerig established 1 July 1959 as the target date for submission of appendices by the other agencies to the District Engineer. He indicated that there had been some delays in the submission of appendices, and that any additional delays may cause a delay in the completion of the report.

6. DESCRIPTION OF PROJECTS. a. Mr. Charles C. McNamara, of the Corps of Engineers, cited the locations, descriptions, and usage of the projects identified as Beltzville, Bernville, Tobyhanna and Tocks Island. The full presentation is Appendix D hereto.

b. Mr. Martin inquired whether consideration was being given to the levels in the reservoirs at which releases would be made to augment low flows, and indicated that if releases were made from the bottom of a reservoir it would be necessary to make observations with regard to oxygen depletion. Mr. Morgan replied that this matter was a detail which did not receive consideration in a survey report, but was considered in the project development stage.



c. Mr. Roy Klein, president of the Lions Club in Bernville, requested that a representative of the Corps attend a meeting of that Club to answer the questions which have arisen among the people of Bernville due to the announcement of a proposed project in that area. Colonel Gerig indicated that he would meet with Mr. Klein and make appropriate arrangements for that purpose.

7. REPORT ON POWER STUDIES. a. Mr. John H. Spellman, of the Federal Power Commission, reported on the progress of the studies by the Power Work Group. He pointed out that the Group was established by the District Engineer for the purpose of examining and reporting on potential projects into which pumped storage power installations could be incorporated including the best type of development, estimates of costs and benefits and economic feasibility of each considered project. Federal members include J. H. Spellman, L. B. Woll, K. W. Ross, Federal Power Commission; and D. E. Donley, Corps of Engineers. In response to the District Engineer's request, electric utility interests in the area appointed a Task Committee to participate in this study and serve as part of the Work Group with Charles A. Carpenter, Pennsylvania Power and Light Co., as Chairman. Other utility representatives are R. A. Lane, Philadelphia Electric Co., Philadelphia, Pa.; M. D. Hooven, Public Service Electric and Gas Co., Newark, N.J.; L. Earle Merrow, Orange and Rockland Utilities, Nyack, N. Y.; E. S. Loane, General Public Utilities Corp., Reading, Pa.; E. W. Bartley, New York State Electric and Gas Corp., Binghamton, N.Y. The Group held meetings on January 15, January 28, April 16 and April 27, 1959. In addition, several informal conferences have been held between staffs of the participating agencies and utilities engaged in the studies.

b. Mr. Spellman stated that the Work Group had concentrated its studies on five sites which appeared to offer the best possibilities for pumped storage installations, namely: Tobyhanna-Beltzville-Lehigh River; Basher Kill, Neversink River; Shohola Falls, Shohola Creek; Flat Brook, Flat Brook; and Tocks Island, Delaware River. He said that preliminary cost estimates have been made for the above sites as well as estimates of power benefits, all based on private utility financing. These have been essentially completed for all but the Tocks Island project. Final decision has not yet been reached with respect to economic feasibility of these projects. However, except for the Tocks Island project, none of these developments appear economically justified at this time. Investigation of a possible pumped storage development at the Tocks Island project, utilizing the 1,200-foot head between the high ridge along the east side of the Delaware River and the Tocks Island site, is continuing and is expected to be completed by the end of June.

c. Mr. Spellman complimented the utility representatives for their excellent cooperation and help in these investigations. He stated that the Work Group report is expected to be completed by the end of June and be submitted to the District Engineer for use in the survey report of the Delaware River basin.

8. STATEMENTS ON THE STATUS OF WORK OF THE OTHER AGENCIES.

a. Mr. Glen Grubb, of the Soil Conservation Service, reported on the status of work by the C. of E. - SCS Joint Work Group. His presentation is Appendix F hereto. In reply to Mr. Goddard's inquiry as to whether the report being prepared by the Joint Work Group would include the seven sites in the Lackawaxen basin and seven sites in the Brandywine basin, which are approved projects under the PL 566 program, Mr. Grubb stated that the sites in the Lackawaxen and Brandywine basin which control more than one square mile of drainage area would be included in that report.

b. Mr. Watson reported on the status of work by the Dept. of Agriculture. His presentation is Appendix G hereto.

c. Mr. Abelson reported on the status of work of the three Bureaus of the Department of the Interior which are participating in the comprehensive survey. His presentation is Appendix H hereto.

d. Mr. Martin introduced Mr. Melvin Scheidt, of the Washington office of the Public Health Service, and then reported on the status of work of the Department of Health, Education and Welfare. His presentation is Appendix I hereto.

e. Mr. James H. Allen, reporting on the status of work of the Interstate Commission on the Delaware River Basin (INCODEL), described the tests made for INCODEL in the Delaware River model at the Corps of Engineers Waterways Experiment Station, in Vicksburg, to determine the movement and dispersion of pollution material discharged in the tidal section of the Delaware River. A series of 14 tests were conducted in which dye was released and its movement traced. This investigation was made on a cooperative basis with the Health Departments of the States of Delaware, New Jersey and Pennsylvania, and the Water Department of the City of Philadelphia. At the direction of the Commission, its staff undertook and completed a study to determine the kind of governmental structure that would be best suited to manage the development of the water resources of the basin. The results of this study have been distributed to the members of the Commission, and they may be used by the Commission as a criterion for evaluating the recom-

mendations to be made by the study group of the Maxwell Graduate School at Syracuse University when its report becomes available for review. In response to a question by Mr. Shanklin, Mr. Allen said that it would take at least a year to complete the final report on the study made at the Waterways Experiment Station and he estimated that a preliminary report will be prepared within two or three months.

f. Mr. Walter M. Phillips reported on the status of work of the Delaware River Basin Advisory Committee. His presentation is Appendix J hereto.

9. REVIEW OF THE FINAL REPORT. The Chairman referred to the discussion the Committee had during its work session, prior to the opening of the meeting, regarding the opportunities that the members, and the agencies they represented, would have for reviewing the final report. Colonel Gerig stated that, based on the assumption that the appendices of all agencies would be available by July 1959, it was anticipated that a public notice covering the broad elements of the overall plan would be issued by the Division Engineer in the spring of 1960. Prior to that time each member of the Committee will have had complete access to all appendices and the draft of the basic report. Opportunity will also be available thereafter for each agency to submit comments to the Board of Engineers for Rivers and Harbors, although it was hoped that all comments will have been received prior to that time. To insure this, it was presently contemplated that public hearings would be held.

10. STATUS OF WORK BY THE CORPS OF ENGINEERS. a. Mr. Russell Morgan, Chief of the Valley Report Group, reported on work done by the Corps on the report proper. The full presentation is Appendix K hereto. Mr. Martin, referring to the paper on water needs which Mr. Morgan presented at the previous meeting, stated that in his opinion the work represented by that paper was a monumental achievement and the paper indicated that a great deal of effort was made to arrive at necessary answers. Mr. Martin added that the Committee was indebted to Mr. Morgan for his effort, and the Chairman concurred in Mr. Martin's views.

b. Mr. Baxter raised the question as to whether the Corps' report would present water needs and reservoir operation studies on the basis of an assumption that the amount of diversion from the Delaware River by New York City permitted by and releases required by the 1954 decree of the U. S. Supreme Court would remain unchanged. He also drew attention to the fact that the Court retained jurisdiction in the case for the purpose of modifying the decree as may be proper in the future. From the discussion that followed, it appeared to the Chairman that a considerable amount of time would be necessary to reach final agreement on how the details of this matter should be treated in the Corps' report; therefore, Colonel Gerig stated that this matter would be inquired into further and that a committee meeting might be called for the purpose of discussing and resolving this particular problem.

c. Colonel Gerig presented a preliminary report on the status of the study being made to determine the feasibility of constructing a barrier in the Delaware estuary. As indicated at the public hearing held in Wilmington, Delaware, on 20 October 1958, the basic purpose of such a structure would be to provide a source of fresh water in a particular area of the basin. In view of this, consideration needs to be given to not only a barrier but to other means of obtaining fresh water for that area. A program of study is under way which will result in a preliminary type of report on the feasibility of the barrier. The program includes the making of certain tests in the model of the Delaware River at the Waterways Experiment Station. The purpose of these tests is to determine the effects that the barrier would have on the tidal heights and on salinity conditions. For the purpose of this portion of the study, the barrier was located 3,500 feet downstream from New Castle, Delaware, and two barrier types were selected for testing. One type (designated as Plan A) consists of a low dam with a fixed spillway and an unobstructed opening, or notch, for navigation. The other (Plan B) arrangement provides for navigation through a low dam with a fixed spillway. Tests in the model were made on the basis of simulated normal tide conditions. Under Plan A, the range of tide immediately downstream of the barrier would be increased to about 7.7 feet from the range of 5.5 feet under existing conditions. The high water would be about 1.2 feet higher and lower water about one foot lower. At the New Castle gaging station, about 3,500 feet upstream from the barrier location, the range would be 2.3 feet as compared to the 5.5 feet under existing conditions. Similarly, at Philadelphia the range would be 3.5 feet versus the present 5.9 feet. Under existing conditions the maximum average velocity of tidal flow is between 3 and 3-1/2 feet per second in the vicinity of the proposed barrier site. Under Plan A the comparable velocity would be about 10 feet per second. Tests made for Plan B showed that the range of tide below the barrier would be 9.2 feet, which is about 3.7 feet greater than the present range. Under Plan B high water would be about 2.2 feet higher and low water about 1-1/2 feet lower than the stages under existing conditions at the barrier location. With respect to the salinity tests, Colonel Gerig reported that no results were available as yet.

d. On the behalf of his colleagues in the State of Delaware, Brigadier General Norman M. Lack (Ret.), who represents that state on the Delaware River Basin Advisory Committee, called attention to the constant water shortage in his state. He stated that the Brandywine River is the state's main source of water and that there is no new source in sight. A new source of fresh water for the downstate area is needed. He suggested that consideration be given to a submerged barrier, the top of which would be 5 feet below mean low water, with an opening of appropriate width and 40-foot depth for navigation. Colonel Gerig stated that the Corps is proceeding with the study to determine alternate economical means of providing additional water for the State of Delaware, as well as further analyzing the effects of the proposed barrier dam.



11. REPORT ON THE STUDY OF THE ORGANIZATIONAL STRUCTURE FOR THE CONTROL AND DEVELOPMENT OF WATER RESOURCES. a. Mr. Guthrie S. Birkhead, of Syracuse University, reported on the study that the University, under a Ford Foundation grant, is making to determine the form of a governmental structure best suited for water resources management in the basin. The text of his presentation is Appendix U hereto.

b. In reply to Mr. Watson's question as to what would be the form of the agency which would continue to do the planning in the basin, Mr. Birkhead stated that it could be one of any number of forms, some of which might be unconstitutional for the reasons stated in his paper.

c. Mr. Johnston remarked that a considerable amount of Federal funds might be involved in the development of a basin plan, and therefore asked whether that was the basic reason for the inclusion of Federal representation in each of the three possible governmental bodies described by Mr. Birkhead as being suitable for the management of water resources development. Mr. Birkhead explained that if he were to identify a single reason as to why there should be Federal representation on such a body, he would not say that it was due to the consideration of financial support, but rather it was due to the fact that the Delaware River basin has an impact on the heart of an urban region and the problems involved are too much of a national interest for the Federal government to ignore.

d. Mr. Martin asked whether Mr. Birkhead and his associates had an opportunity to study the Potomac River compact, under which the agency is very limited in function but does approach a partnership arrangement among the Federal government and the states. In reply Mr. Birkhead stated that while they had tried to cover as wide a field as possible, they paid special attention to all of the eastern basins, and were acquainted with the recent report on revising of the structure of INCOPOT.

12. PUBLIC INFORMATION PROGRAM. Mr. James Kerney, Jr., Executive Vice-President, Water Research Foundation, Inc., formerly Delaware River Basin Research Corporation, Inc., explained the need for a public information program and outlined the work done in this direction by his organization. The full presentation is Appendix L hereto.

13. COMMENTS BY STATE MEMBERS. Representatives of the states reported on the policies of their respective Health Departments on the use of low flow augmentation in lieu of a degree of sewage treatment higher than primary.

a. Mr. David S. Davies, of Mr. Bontempo's staff, read a paper giving the views of the State of New Jersey. The presentation is Appendix M hereto.

b. Mr. Goddard's presentation for the Commonwealth of Pennsylvania is Appendix N hereto.

c. Dr. Kaplovsky's presentation for the State of Delaware is Appendix O hereto.

d. Mr. Ronald B. Peterson reported that the State of New York is willing to accept primary treatment where the natural stream flow or augmented flow from some other source, such as impounded reservoirs is adequate to maintain the stream standards as classified. There may be occasions where treatment in addition to primary treatment plus chlorination would be required due to the downstream use of the water for drinking purposes. In these cases the dissolved oxygen content would not be the controlling factor. Secondary treatment would be required to reduce the coliform density to an acceptable limit.

14. RESULTS OF FLOOD DAMAGE STUDIES. Mr. Marshall R. Iakisch, of the Valley Report Group, presented the results of the flood damage studies including average annual damages which will be used as the basis for economic justification of flood control measures in the basin. The full presentation is Appendix P hereto.

15. RESULTS OF RESERVOIR OPERATION STUDIES. Mr. George Mondrillo, of the Valley Report Group, presented a paper on reservoir operation with particular reference to water supply. The full presentation is Appendix Q hereto.

b. Mr. Martin raised a question about the re-use factors which were applied in converting from gross to net water demands. In reply it was stated that the re-use factors employed at this time were purposely kept low to provide a measure of conservatism in setting up the water supply system. When the current USPHS study on withdrawals is completed and firmer data on re-use are available the system analysis described in this paper will be revised.

c. Mr. Baxter inquired about the adequacy of the system to meet water demands if a drought were to occur in 1970 or 1980. A water supply system designed by matching water demands with net project yields would be capable of sustaining the demand at any time during the course of development of the water supply reservoir system.

d. In reply to Dr. Kaplovsky's question it was indicated that the water demands used in this study did not include irrigation needs. The indicated system would provide about 40% of the combined ultimate flows of the Schuylkill and Delaware Rivers at the Philadelphia and Trenton gages.

16. DISCUSSION OF ALLOCATION OF COSTS. Mr. James R. Johnston, of the North Atlantic Division Office of the Corps of Engineers, discussed the concepts and principles inherent in the procedures used by the Corps of Engineers in allocating project costs to project purposes. The full presentation is Appendix R hereto.

17. PAPERS BY THE DEPARTMENT OF AGRICULTURE. a. Mr. Vincent McKeever, of the Soil Conservation Service, presented a paper on the purpose of small dams. His presentation is Appendix S hereto.

b. Mr. Gilbert L. Varney, of the Forest Service, presented a paper on forestry in the Delaware basin. This presentation is Appendix T hereto.

18. SUMMARY. In his summary of activities during this meeting, Colonel Gerig reiterated that each member of the Committee would have complete access to all appendices and to the draft of the basic report at about the end of this calendar year. He strongly recommended that everyone avail himself of the opportunity to visit, immediately after lunch recess, the Corps of Engineers' Bear Creek Flood Control under construction on the Lehigh River. With regard to the next meeting, Colonel Gerig said that he would leave the announcement of it up to the new Chairman who would assume his duties about 1 July 1959.

*Frank A. Gerig, Jr.*  
FRANK A. GERIG, JR.  
Lt. Colonel, CE  
Acting District Engineer and  
Acting Chairman, Delaware Basin  
Survey Coordinating Committee

MINUTES OF THE NINTH MEETING  
OF THE  
DELAWARE BASIN SURVEY COORDINATING COMMITTEE  
HELD 9 OCTOBER 1959  
IN TRENTON, NEW JERSEY

1. ATTENDANCE. a, The Committee was convened in the Terrace Room of the Stacy-Trent Hotel on 9 October 1959 by Colonel Truman H. Setliffe, Chairman. The following members were in attendance:

Mr. Mark Abelson	Department of the Interior
Mr. S. S. Baxter	City of Philadelphia
Mr. S. A. Bontempo	State of New Jersey
Mr. A. C. Ford	City of New York
Mr. C. B. Friday	for Mr. R. B. Peterson, State of New York
Dr. A. J. Kaplovsky	for Mr. R. A. Haber, State of Delaware
Mr. S. C. Martin	Department of Health, Education & Welfare
Mr. B. D. Murphy	for Mr. M. K. Goddard, Commonwealth of Penna.
Mr. Marvin Shirley	for Mr. J. F. Foy, Department of Labor
Mr. J. H. Spellman	Federal Power Commission
Mr. A. C. Watson	Department of Agriculture

b. The names of the 117 persons who registered and attended the meeting are listed in Appendix A hereto.

2. OPENING REMARKS. Colonel Setliffe announced that on 1 July 1959 he took command as District Engineer of the U. S. Army Engineer District, Philadelphia. As District Engineer he is also Chairman of the Coordinating Committee. The Chairman acknowledged the fine work of his predecessors on the report and assured the members that he would do his part to see that the fine spirit of cooperation and industry, which has prevailed, is preserved. He stated that the "Quaker way of conducting meetings" seemed to have produced excellent results and he reiterated the procedures for conducting a Quaker meeting.

3. INTRODUCTIONS. The Chairman introduced Mr. R. A. Hertzler of the Office of the Assistant Secretary of the Army; Colonel S. E. Smith, Mr. Henry C. C. Weinkauff and Mr. E. W. Landenberger of the Office of the Chief of Engineers; Mr. B. H. Dodge and Mr. G. Tapley of the North Atlantic Division Office; and Mr. Richard D. Murray from the staff of the Board of Engineers for Rivers and Harbors.

4. ANNOUNCEMENTS. a. Colonel Setliffe announced that Mr. Lisovitch was absent from the meeting due to a post-operation recovery period. Mr. Walter M. Phillips, Executive Secretary of the Delaware River Basin Advisory Committee, suggested that the regards of the members be conveyed to Mr. Lisovitch. The members concurred unanimously and the Chairman indicated that he would take appropriate action.

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b. The Chairman noted that three persons who contributed support and work to the survey from its earliest days have accepted new assignments out of the basin area. They are Mr. Fred H. Larson, of the Soil Conservation Service, Mr. Lyle H. McDowell, of the National Park Service and Mr. M. B. McPherson, former alternate member for the City of Philadelphia. The Chairman commented on their fine reputations and wished them the best of luck in their new jobs.

c. Mr. S. C. Martin, at the request of the Chairman, announced that the U. S. Senate Select Committee on Water Resources would hold a public hearing in Philadelphia on 30 October, and again on 7-8 December. Colonel Setliffe said at least one Corps' observer would be present at the 30 October hearing and that the Corps' report would be made at the Washington level.

d. At the previous meeting, the members requested Lt. Col. Frank A. Gerig, Jr., to send letters to Colonel W. F. Powers and Mr. D. R. Gascoyne, expressing the Committee's appreciation of their contribution to the work of the Committee. Colonel Setliffe reported that the action was taken, and he read copies of the letters.

e. The Chairman introduced Major Howard W. Durham, who was recently assigned to the Valley Report Group. He then cited six open meetings concerning the comprehensive survey which he and/or his staff members have attended since 1 June 1959. The meetings were, in essence, local public hearings with much time devoted to questions and answers.

5. COMMENTS ON MINUTES OF PREVIOUS MEETING. a. It was explained by the Chairman that in preparing the minutes of the previous meeting, it was planned to have the comments of Mr. Spellman incorporated as Appendix E. After a large part of the minutes was printed, a request was received from Mr. Spellman that his comments be incorporated in the body of the minutes; therefore, the letter "E" was left unused in identifying the appendices.

b. To clarify points raised by Mr. Baxter regarding the review of the report proper, the Chairman reviewed the steps which the report proper will undergo from its initial draft through completion. These review steps are Appendix B hereto. Mr. Martin asked if any provision would be made for members to see what was done with dissenting opinions, if they would see the letter of transmittal and if they will become a part of the report. The Chairman answered that all letters he writes forwarding the report will become a part of the record and a matter for all members to consider.

c. The second sentence of item 15.c on page 8 of the minutes of the eighth meeting stated "A water supply system designed by matching water demands with net project yields would be capable of sustaining the

demand at any time during the course of development of the water supply reservoir system." Mr. Baxter questioned whether the studies reported in reservoir operation studies shown in Appendix Q to the minutes, showed that the reservoir system proposed in Appendix Q would meet the water needs of the Valley if the low flow period of the 1930's was repeated in 1970 or 1980. The answer was in the affirmative.

d. The minutes, with clarifications, were approved.

6. TREATMENT OF THE EFFECT OF THE U. S. SUPREME COURT DECISION.

a. The method of handling the 1954 decree of the U. S. Supreme Court was discussed at some length at the eighth meeting and the Chairman of that meeting suggested it be committed to an Ad Hoc Committee. Colonel Setliffe stated he felt the initial effort to resolve the matter should be by correspondence. Accordingly, a draft was submitted to members of the Committee representing the cities of New York and Philadelphia, for comment. The Chairman intended that the statement would be redrafted in the light of the comments and submitted to the Committee at this meeting. The statement is simply an expression of broad planning guides currently applicable to the water resources of the Delaware River basin. The guides may form their way into the appendix on formulation of the plan of development and, to a lesser extent, into the report proper but it is not proposed that the statement be reproduced intact either in the report or any appendix. The report will, however, recognize the possibility that in the future the planning guides may prove to be of less than optimum accuracy and it will recommend review of the plan of development as experience warrants.

b. Ample opportunity will be afforded for comments on the planning assumptions and guides used in arriving at the comprehensive plan of development. All views and opinions will be incorporated in the report proper or in records of hearings accompanying the report or will accompany the report as supporting papers.

c. The present planning studies treat the 1954 decree of the Supreme Court as an existing feature of the basin. The soundness of this treatment is attested to in several ways, the most recent being the action of the Governors and Mayors at their meeting on 30 September.

d. Mr. Baxter pointed out that the decree has one chapter which allocates certain amounts of water, but another chapter which says that the Supreme Court may reopen this matter at any time or on the motion of either party. The Chairman replied that it appeared to him that the appointment of a committee to draft the legislation for interstate and Federal agreement again reaffirmed the statement that the Committee shall recognize those Delaware River basin projects presently constructed or under construction.

e. Mr. Ford commented that in New York the feeling has always been that the Army has to state, in the plan, the expected period of time that the projects will furnish the needs of all the people in the area. This has been done to New York's satisfaction as the yield of the basin under the plan of development would meet all the needs to the year 2010. Mr. Ford said that the report should not become a forum for any controversial matter and that engineers and scientists should stay in their own field of competence and leave the Supreme Court for legislators and the courts.

7. PROGRESS AND SCHEDULES. a. Slides were shown to illustrate: the seven step process covering the procedures for preparation and review of the written material going into the report and its appendices (see Appendix C-1 attached); the list of appendices being prepared by agencies other than the Corps (see Appendix C-2 attached); the eleven appendices being prepared by the Philadelphia District office (see Appendix C-3 attached); the status of the eleven chapters of the basic report (see Appendix C-4 attached). The Chairman drew attention to the fact that the third slide (Appendix C-3) Appendix R is a joint effort between the Corps of Engineers and the Soil Conservation Service.

b. The Chairman said that the last paragraph of his news release of 10 August 1959 sums up the picture of status fairly well. He read the paragraph as follows: "The basic studies, the drafts of the 24 appendices, and the report proper will be substantially completed in draft form approximately December 31, 1959. The administrative procedures such as final drafting, review, collation, editing and reproduction are time consuming; and hence our completion of the report is scheduled for May 1960. We will make every effort to expedite an earlier completion.

c. In response to Mr. Martin's question as to when he could see the drafts of Appendices Q and V, Mr. Morgan replied in about 3 or 4 weeks. Mr. Martin then asked if comments received on drafts should be attached thereto after they have been incorporated in the report. Col. Setliffe said this was not to be done, the originals are in the District Office, and are available to any member who comes in to see them. Mr. Baxter questioned the meeting of deadlines and was told by the Chairman that all realize deadlines cannot always be met and if one of several parts of an appendix is not ready, the other parts should be submitted.

8. TREATMENT OF APPENDIX X, OPERATING ORGANIZATION. On 21 September 1959 the Water Research Foundation made public an abbreviated version of the Syracuse Report. The larger report contains over 500 pages. The abbreviated version contains, in essence, the main findings and recommendations. Because of the time and money entailed, the Chairman stated that it has been decided tentatively to publish the brief version as Appendix X to the Corps' report. Any comments received will be furnished to the Water Research Foundation and will be used as attachments to the appendix. Colonel Setliffe's full statement on the Syracuse Report is Appendix D hereto.



The Chairman asked each member of the Committee, as well as representatives of the Delaware River Basin Advisory Committee and the Interstate Commission on the Delaware River Basin, for his views with regard to the proposed treatment of Appendix X. It was the sense of the meeting that the brief report would be reproduced and distributed for review and comment and that the comments would be forwarded as attachments to that appendix.

9. STATUS OF PLANNING STUDIES. a. Mr. Russell Morgan presented this discussion, the full presentation is Appendix E hereto. The Chairman said there will be additional recommendations and consideration will be given to other measures of flood control. In response to a question by Mr. Baxter, Mr. Morgan said the recommendations of major dam structures were based on water demand. The Chairman observed that Blue Marsh is an alternative for the Bernville project. The selection of one or the other will be based purely on engineering matters. Mr. Baxter pointed out that at the last meeting, the sequences were a lot different. Mr. Morgan replied that the reassignment of dates came about as a result of the maximization studies.

b. The Chairman said that the small reservoirs in the Brandywine watershed are not shown on the map of control structures because the map shows only structures being considered as elements of the comprehensive plan. The Brandywine structures are included in approved watershed programs.

10. STATUS OF STUDY ON THE FEASIBILITY OF DELAWARE ESTUARY BARRIER DAM. The full presentation by Mr. A. A. Klein of the Philadelphia District Office is Appendix F hereto. General Norman M. Lack said that the State of Delaware has three counties and it was hoped that the barrier would cover not only one county, but two, and possibly three counties. The Chairman said that the Corps is concerned with the effect of the barrier on the State of Delaware and the report will so indicate. Dr. Kaplovsky asked how soon the Committee will see the Albright & Friel report, and Mr. Murphy asked if that report takes into account the effects of development in the Brandywine. Mr. Klein answered that the report would be available in about two weeks, and covers only the Christina and Newark Reservoirs plus the Delaware River intake at Philadelphia.

11. LOCAL COOPERATION REQUIREMENTS. a. The full presentation by the Chairman is Appendix G hereto. Mr. Friday said that the State of New York feels that it would be inappropriate at the present time to attempt to provide assurances of financial participation by local interests or by the State. His reasons were that the major portions of the plan appear to have little potential effect on New York State and no assurance can be given now as to the conditions or extent that any Congressional authorization might require local participation. Furthermore, it is assumed that the plan finally recommended by the Corps for implementation may be subject to revision both as to scope and schedule. Mr. Friday



added that the State of New York will be glad to consider the appropriateness of financial participation when the plan is implemented by legislation, under whatever circumstances prevail at that time.

b. Mr. Murphy said the Commonwealth of Pennsylvania pledges its cooperation but the assurance would have to be general in scope because the amount of money to be made available is a function of State legislature.

c. The Chairman observed that, without the benefit of the evaluation by Mr. Friday, the proposition submitted by the Corps is general in scope. It recognizes that individual problems will be reviewed as received, that cost sharing will be considered, and that there will be a seeking to answer locally what financial arrangement will be made. Mr. Friday said it was his impression that the statement of assurance required a statement of concurrence with the plan. The State of New York could not do this because it has not seen the report into which the statement is to be incorporated.

d. The Chairman emphasized that what is needed now is the kind of assurance that expresses interest and sympathy at this stage. There are several stages at which assurances are given and with each stage there will be a decrease in generality and an increase in the specific. The final stage will be the payoff stage. Mr. Weinkauff clarified the point that the assurance only comes when the report is in its final stage. All that is desired now is an indication of the willingness and ability to meet the conditions.

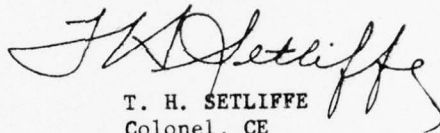
e. Mr. Bower said that assurance must be given before Congressional approval is requested and he wanted to know what degree of assurance is required at this stage. He indicated that New York State is reluctant to give assurance, when Congress might change the particular plan. Mr. Weinkauff replied that if Congress should contemplate making a change, there would be discussions and interested parties would again be able to present their case. He stated further that this is not a new procedure, that all the States have previously participated in these assurances on new projects. The type of assurance is the same; the cost sharings are the same as in existing regulations and legislation. Mr. Hertzler said that a sample letter could be requested from the Corps.

f. It was the sense of the meeting that the members would consider the problem on a new basis, that each State will make the best effort it can to obtain the assurance and that the Corps will discuss with each of the States individually the acceptability of that best effort.

12. PUBLIC HEARINGS. This presentation by the Chairman is Appendix H attached hereto. The Chairman said that consideration will be given to holding one public hearing in each of the four basin states. It was the sense of the meeting that "hearings in reverse" should be held. The public should be told the results of the studies and asked for its opinion of the results. The Chairman requested members to phone or write him if they have any suggestion for the hearings.

13. GENERAL, INCLUDING SUGGESTIONS FOR NEXT MEETING. a. Mr. Murphy announced that Mr. Goddard was not present at the meeting because he was receiving an honorary degree of Doctor of Science at the Waynesburg College in Pennsylvania.

b. The Chairman announced that the next meeting will be held either in early December or early January.



T. H. SETLIFFE  
Colonel, CE  
District Engineer and  
Chairman, Delaware Basin Survey  
Coordinating Committee

MINUTES OF THE TENTH MEETING  
OF THE  
DELAWARE BASIN SURVEY COORDINATING COMMITTEE  
HELD 31 MARCH 1960  
IN ATLANTIC CITY, NEW JERSEY

1. ATTENDANCE. a. The Committee was convened in the Solarium of Madison Hotel, Atlantic City, New Jersey, on 31 March 1960 by Colonel T. H. Setliffe, Chairman. The following members were in attendance:

Mr. Mark Abelson	Department of the Interior
Mr. Samuel S. Baxter	City of Philadelphia
Mr. Salvatore A. Bontempo	State of New Jersey
Mr. Henry Gallien, Jr.	for Mr. R. B. Peterson, State of New York
Dr. M. K. Goddard	Commonwealth of Pennsylvania
Mr. James P. Haltigan	for Mr. J. F. Foy, Department of Labor
Dr. A. Joel Kaplovsky	for Mr. R. A. Haber, State of Delaware
Mr. Sylvan C. Martin	Department of Health, Education & Welfare
Mr. August Schofer	Department of Commerce
Mr. John H. Spellman	Federal Power Commission
Mr. Vincent G. Terenzio	for Mr. A. C. Ford, City of New York
Mr. Alvin C. Watson	Department of Agriculture

b. The names of the 76 persons who registered and attended the meeting are listed in Appendix A hereto.

2. OPENING REMARKS. Colonel Setliffe stated that the Committee had now completed a circle as far as location of meeting places was concerned. The first meeting was held in Atlantic City in April 1957 and now, three years later, the 10th, and probably the last, meeting was being held at the same location. The Chairman said that the announcement for this meeting, unlike the previous ones, was sent to a restricted invitation list because the principal business to be discussed was the material to be presented at the "public hearings in reverse," and that he wished to present this material to the Committee prior to presenting it at the hearings.

3. INTRODUCTIONS. The Chairman introduced Mr. Schofer, of the Department of Commerce, who was attending his first meeting of the Committee; Mr. R. A. Hertzler, of the Office of the Assistant Secretary of the Army; Mr. E. W. Landenberger, of the Office of the Chief of Engineers; and Messrs. B. H. Dodge and G. Tapley of the North Atlantic Division Office. Mr. A. C. Watson introduced Mr. H. Kautz, Chief of the Engineering and Planning Unit of the Soil Conservation Service, Upper Darby, Pa., who was attending a meeting of the Committee for the first time. Mr. V. G. Terenzio introduced Mr. S. Brandes of the Law Department, and Mr. S. Dore of the Board of Water Supply, of New York City.

4. COMMENTS ON MINUTES OF PREVIOUS MEETING. The Chairman stated that no comments had been received in the mail regarding the minutes of the October meeting, and that unless someone desired to present comments from the floor, the minutes would be approved without modification. There were no comments.

5. PREPARATION OF AND REVIEW PROCEDURE FOR THE MAIN REPORT.  
a. Colonel Setliffe said that in spite of the many difficulties encountered in assembling and correlating the material for and drafting the main report, every effort was being made to have it ready in May 1960 for informal review by the Division Engineer and the Chief of Engineers. This will be done before it is reproduced for final submission. It had been the understanding that the first draft of the chapters of the main report would be reproduced as they became ready and distributed to Members of the Committee and to the participating agencies for review and comment. However, it has been decided that in order to save time and effort of all concerned, the review procedure must be changed. Copies of the first drafts will be distributed to the Members and to the co-operating agencies for information only.

b. Colonel Setliffe stated that the report to be submitted to the Division Engineer must reflect the views of the District Engineer and not those of the Committee. Until the report has the concurrence of the Division Engineer and the Chief of Engineers, it is conceivable that comments made by any of the cooperating agencies would not be valid or applicable. He said that the formal procedure for obtaining the views of the cooperating agencies and local governments and interests had been established. The interested organizations will review and comment on the report as proposed by the Chief of Engineers. The comments will then be attached to and forwarded with the report through channels to the Public Works Committees of the Congress.

c. The Chairman felt the need for recapitulating the steps pertaining to the processing of the report. The revised review steps are shown in Appendix B. The Chairman stated that the list of steps would be reproduced and mailed to each member on the following day. These steps allow each agency with a viewpoint differing from that expressed in the report an opportunity to make comment which will become a permanent attachment to the report. This concluded the Chairman's remarks.

d. Dr. Kaplovsky asked what the report will consist of when it is sent to Congress. Colonel Setliffe stated that the report will consist of the Corps' report and the appendices prepared by the Corps and the several cooperating agencies and also the comments of the States, Cities and other Federal agencies.



e. Mr. George Shanklin of the State of New Jersey asked whether a formal statement of the Governors would be required only after the report is sent to the Board of Engineers for Rivers and Harbors. Colonel Setliffe stated that the Board may hold public hearings, if requested to do so by local interests and if assured that by so doing something new and different may be brought out. After the Board makes its recommendations to the Chief of Engineers, he will send the report to the Federal agencies concerned, the Governors and the Mayors for review and comment. Comments received will be considered.

f. Dr. Goddard suggested "enough time to get everyone in agreement" after "informal review" by the Division Engineer instead of waiting until after the report had been submitted to the Board of Engineers for Rivers and Harbors. He then asked how much time would be allowed. Colonel Setliffe said that a period of 15 to 21 days would be given. Dr. Goddard stated that questions could not be resolved in that time and that it would be desirable to have more time now and less later on. Colonel Setliffe said that he felt certain that the report which will be submitted to the interested parties will be little different from what has already been presented, and commented upon at Committee meetings and in various study papers.

g. Dr. Goddard wanted to know when the word "tentative", in connection with the inclusion of a reservoir in the plan would be dropped and the project be definitely included therein. Colonel Setliffe said that when the report is submitted to the Division Engineer it will contain what is then felt to be the best plan.

h. Mr. Baxter wanted to know what the report would say regarding the views of the Coordinating Committee, since it may not necessarily indorse the report as submitted. Colonel Setliffe said that a statement will be in the report which indicates that there was a Committee, the purpose of the Committee, and that the report as forwarded by the District Engineer did not carry with it the agreement or disagreement of the Committee members with regard to the findings and recommendations of the District Engineer. Dr. Goddard said that it was his desire to get as close as possible to unanimity.

i. Mr. Shanklin suggested that in order to help acquire the sites for the auxiliary reservoirs, Phases A and B plans should be used as established in earlier stages of the studies. Colonel Setliffe stated that this would not be done; the phase feature had been replaced by an estimated timetable.

j. Mr. Shanklin remarked that it was essential that the local people acquire the sites now. Colonel Setliffe indicated that local interests could do so, and stressed the fact that this was not a report on projects for the Corps of Engineers since there is a lot more work to be done by others than by the Federal government.

k. Dr. Kaplovsky remarked that some of the members had not seen all of the chapters of the main report and asked if the 15-20 days' time could be increased. In Dr. Goddard's opinion six weeks' more time was needed now rather than later. Colonel Setliffe replied that after the chapters are examined the required time can be determined. If there are major areas of disagreement and more than six weeks are needed to resolve them, a letter to him requesting additional time would be in order.

l. Dr. Goddard stated that all the reservoirs in the plan should be referred to as "for development" and not "for future or partial development." Colonel Setliffe stated that the deletion of the words "future" or "partial" would be taken under consideration and a decision made as soon as possible. It is difficult to decide at what point this plan becomes "the plan." There being no more questions, the Chairman asked Mr. Russell Morgan to give a statement, as had been done in previous meetings, on the status of the report.

6. STATUS OF REPORT. a. Using two charts, one listing the 24 appendices to the report and the other listing the 11 chapters of the report, Mr. Morgan presented information on the status of each element. His full presentation is Appendix C to these minutes. Mr. Morgan then asked if there were any questions.

b. Mr. Shanklin said that he thought that Chapter VI, "Water Resources Development and Associated Programs," instead of Chapter IX, "Discussion," is where the cooperating agencies' differences of ideas and evaluation problems should be discussed. Mr. Morgan said that no formal review of the draft of the report and chapters has been proposed since there is a question as to whether the overall analysis of the effects of the plan would be subject to comment by the reviewing agencies and, if done, at what time. He stated further that if any formal comment is in order, then it should be in Appendix Q, "Formation of the Plan of Development," which discusses the overall plan. The reason that formal review of Appendix Q, which presents the various steps of the procedure, has not been scheduled is because the actual procedure for picking this plan has been reported on at prior meetings of this Committee. Mr. Shanklin said that Chapter VI is what each one will have to explain to his State and yet Appendix Q contains the basic reason for the plan recommended.

c. Colonel Setliffe stated that copies of Appendix Q and report chapters would be sent to the members, but comments would not be requested; however, there was no desire to "shut the door", and if there were things that should be known, or some comments to be made, Members should send them to the District Engineer and they will appear somewhere in the report or be forwarded with it. The District Engineer's plan as defined by present thinking, has been indicated. Every effort will be made to keep to the schedule.

d. Mr. Martin asked whether the Members would be furnished copies of what goes to the Division Engineer. Colonel Setliffe replied that every Member of the Coordinating Committee will receive a copy of each appendix and the chapters of the report in final form. Then he asked Mr. Morgan whether final copies of the appendices were being sent to the Members. Mr. Morgan answered that each author agency was being furnished two copies of the appendix it prepared. Colonel Setliffe then directed Mr. Morgan to send a copy of each appendix in its final form to each Member. Mr. Morgan replied that this would be done at an early date. Mr. Shanklin then remarked that the Governor's comments on his review would be received more quickly if appendices in final form were furnished as they were completed. Colonel Setliffe observed that there were not going to be any major changes in the appendices between now and when they were transmitted by the Chief of Engineers to the Governors for consideration.

7. PRESENTATION FOR "HEARINGS IN REVERSE." a. In introducing his proposed presentation for the "hearings in reverse", Colonel Setliffe requested the Committee Members to take such notes as they deemed necessary and also to jot down any question which they thought might be asked at the proposed public hearings. The notes and questions would be discussed after the completion of the second portion of the presentation. Using a "Vugraph" and a film projector in conjunction with a script, Colonel Setliffe gave his presentation in five parts. They were:

First - the origin of the study; the organization to do the job; who participated in the work; and the assignment of specific tasks.

Second - the projected growth of the basin and its relation to water resources.

Third - the needs of the basin as determined by the various agencies.

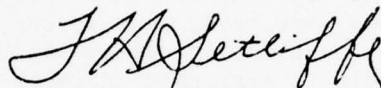
Fourth - the tentative water control plan under consideration and a logical sequence for its development

Fifth - how the plan satisfies various need.

b. At the conclusion of the talk and in response to the speaker's request, Members raised questions and made comments on the material presented with a view to clarifying or supplementing various points of the presentation.

8. PRESENTATION OF A RESOLUTION. The Chairman then presented a resolution for the action of the Committee. The resolution expresses to Mr. Russell Morgan, and his staff, the Committee's gratitude and appreciation for his efforts in the conduct of the survey and participation in the meetings of the Committee. The resolution was properly moved and passed. The resolution is Appendix D.

9. The meeting adjourned at 2:00 P.M.



T. H. SETLIFFE  
Colonel, CE  
District Engineer and  
Chairman, Delaware Basin Survey  
Coordinating Committee



REPORT ON THE  
COMPREHENSIVE SURVEY  
OF THE  
WATER RESOURCES  
OF THE  
DELAWARE RIVER BASIN

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APPENDIX B

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ECONOMIC BASE SURVEY

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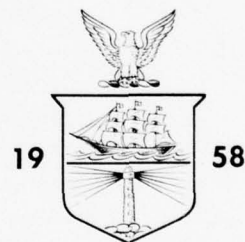
PREPARED BY  
U. S. DEPARTMENT OF COMMERCE  
OFFICE OF BUSINESS ECONOMICS  
FOR  
U. S. ARMY ENGINEER DISTRICT, PHILADELPHIA  
CORPS OF ENGINEERS  
PHILADELPHIA, PA.

# **ECONOMIC BASE SURVEY**

## **OF THE**

# **DELAWARE RIVER SERVICE AREA**

**PREPARED FOR**  
**THE CORPS OF ENGINEERS**  
**U. S. ARMY ENGINEER DISTRICT**  
**PHILADELPHIA, PA.**



**U. S. DEPARTMENT OF COMMERCE**  
**OFFICE OF BUSINESS ECONOMICS**

DEPARTMENT OF COMMERCE  
OFFICE OF BUSINESS ECONOMICS  
WASHINGTON 25, D. C.

Letter of Transmittal

This Economic Base Survey of the Delaware River Service Area has been prepared for the United States Army Corps of Engineers. It was understood at the outset that the Office of Business Economics would analyze economic characteristics, developments, and trends, and would present projections of future growth; further, that the projections both for the Nation and the Delaware Area would be based primarily upon an extension of fundamental trends.

Our underlying assumptions are described in this report, and the projections should be viewed in that context. While not intended as forecasts, the data provide a meaningful framework within which inquiries involving broad future growth may be pursued.

In preparing this report a wide variety of data -- such as those underlying the measures of output and income utilized here -- have been developed for, or brought to a focus on, the Delaware River Service Area and its sub-regions. This report presents OBE's first comprehensive regional measures for areas smaller than States. It should, therefore, be of wide utility to all engaged in the construction of regional measures of economic trends.

We feel that the limitations of a study of this kind, extending as it does well into the future, should be noted but not overstressed. Prior to the undertaking there was an understanding of what was feasible, and we have endeavored to meet the original expectation in this report. However, it should be pointed out that, while trends for the United States and the Delaware Area as a whole provide a reasonable basis for appraising future developments, the projections for the sub-regions afford less reliable guides, and these smaller-area figures should be viewed accordingly.

The Office of Business Economics had excellent cooperation in developing this report, and acknowledgment is made in a following statement. The Corps of Engineers at all times was most helpful and cooperative, and we have found our association with those carrying out this important project a rewarding one.

*M. Joseph Meehan*  
M. Joseph Meehan  
Director

June 27, 1958

#### Note on Date of Study

This economic base survey was transmitted to the Corps of Engineers initially in June 1958, with its historical portion generally covering the years 1929-55. In November 1959, the report was updated by extending the various historical income estimates and corresponding analysis through 1957 and by revising the earlier figures for 1955 as necessary. No changes were made in the charts which illustrate basic relationships that are not changed substantively by a two-year extension of the historical time series. Similarly, the updating did not affect the projections.



## FOREWORD

by the

Assistant Secretary of Commerce

When the Department of Commerce was requested by the U. S. Army Corps of Engineers to prepare an Economic Base Survey as part of the Corps' extensive study of the water resource developments of the Delaware River Basin, I agreed because of the substantial direct and indirect benefits that would flow from our cooperation.

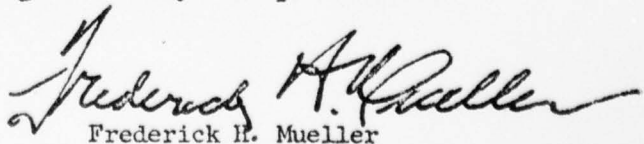
Agreement as to the scope of the base survey and the results that the Department was prepared to furnish was reached in discussions with my Deputy Assistant Secretary, Carl F. Oechsle, officials of the Office of Business Economics, and Lt. Col. John C. H. Lee, Jr., acting on behalf of Col. Allen F. Clark, Jr., Philadelphia District Engineer.

Aside from the immediate utility to the Philadelphia District Corps of Engineers, the report affords important analytical guides for other regional work. Its contents may be drawn upon by business concerns and others faced with industrial location, marketing and similar economic problems.

The original objective has been met through mutual understanding and close coordination between the Office of Business Economics and the Philadelphia District Corps of Engineers -- in the initial stages with Col. Clark and Lt. Col. Lee, and later with Col. W. F. Powers, the present District Engineer, and Lt. Col. Frank A. Gerig, Jr. The Chief of the Valley Report Group, Russell Morgan, cooperated with us at all times.

The Office of Business Economics has in its turn benefited from the assistance rendered by a number of other agencies. The Department's Bureau of the Census provided the basic population data and various alternative national projections of both population and households, and many State government offices furnished other materials.

This report was prepared under the supervision of M. Joseph Meehan, Director of the Office of Business Economics. OBE worked out the approach, techniques, and innumerable calculations which this report embodies. It assumes responsibility for the contents of the report, including the findings and analytical presentation.



Frederick H. Mueller  
Assistant Secretary of Commerce

#### ACKNOWLEDGMENTS

In the preparation of this Economic Base Survey the Office of Business Economics placed heavy demands upon selected staff members, and had the benefit of the cooperation of a number of Federal and State agencies.

Louis J. Paradiso, Assistant Director and Chief Statistician, was in general charge of the statistical research for the project. C. A. R. Wardwell, Chief of the Current Business Analysis Division, and Robert E. Graham, Jr., Chief of the Regional Income Section in the National Income Division, were responsible for the development of the basic measures for the Delaware Area. All took an active part in the numerous inter-agency conferences which contributed to the closeness of understanding and cooperation characteristic of the Delaware River Basin project as a whole. These individuals established and maintained the channels with State and local agencies through which a great deal of highly useful material was developed for the Economic Base Survey.

Charles F. Schwartz, Assistant Director and Chief Economist, assisted in the shaping and development of the report, particularly the general economic review of the United States and of the Delaware Area contained in Chapters I and II. Other principal contributors to the formulation of the data and findings were Loughlin F. McHugh, who drafted the initial chapter, and Walther Lederer, who was concerned with the foreign trade aspects of the study treated in Chapter IV.

Mr. Wardwell was assisted throughout the project by L. Jay Atkinson. Cecelia W. Craig carried out much of the statistical work underlying Chapter III. In the preparation of the special personal income estimates forming the basis of Chapter II, Mr. Graham was aided principally by Edwin J. Coleman and Charles J. Libera. The graphic presentations were prepared by Anna M. Guindon and John A. Miskell.

The Bureau of the Census was responsible for the national projections of population in this report, as well as the corresponding figures on households and the special estimates for 1955 and 1956 of population by counties for the Delaware Area. These data were prepared by Jacob S. Siegel, Chief of the Population Estimates and Projections Section of the Population Division. Mr. Siegel was helpful also in furnishing further information and advice enabling meaningful use of the population projections.

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ARMY ENGINEER DISTRICT PHILADELPHIA PA  
REPORT ON THE COMPREHENSIVE SURVEY OF THE WATER RESOURCES OF TH--ETC(U)  
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The reliability of the historical series on personal income and employment for the Delaware region was enhanced by the cooperation of various government agencies in providing special tabulations of data. The cooperation of the Governors and of State agencies in furnishing needed series thus contributed to the improvement of the projections themselves. Special acknowledgment is due to the employment security agencies of the several States in the Area. They provided valuable payroll and employment statistics, classified according to industry, for each county under the State unemployment insurance programs.

In New York State, the Department of Taxation and Finance made available from State income tax returns county data covering several years, and thus supplied important benchmark material in estimating property income received in the local area. The New York State Department of Commerce furnished a number of special tabulations of employment, including previously unpublished material.

The New Jersey Department of Conservation and Economic Development compiled special tabulations of payrolls and employment through its Bureau of Planning and Commerce. In Pennsylvania, a similar service was rendered by the Bureau of Statistics of the Department of Internal Affairs. In addition to making available necessary payroll and employment information by counties, officials of the State of Delaware provided assistance on local sources of data.

Finally, the Office of Business Economics wishes to express its appreciation of the cooperation of the Philadelphia District Corps of Engineers at all stages in facilitating the progress of our work on this Economic Base Survey.



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## INTRODUCTION

This report is a basic economic survey designed to present guides for appraising the future growth of the Delaware River Service Area in relation to its water requirements.

The need for water is dependent upon the volume of economic activity within an area and the size of its population. More specifically, domestic consumption of water appears to be a function related to population and economic growth, the latter being the prime factor in the increase in water use per capita. Industrial use of water is determined mainly from the changes in the activities of various important water-using industries, allowing for the effects of shifts in product output and changes in technology.

With some exceptions, physical activity measures are not available by regions. To portray the overall growth of the Delaware region — one embodying not only the effects of industrial operations but also all of the other economic activities engaged in by the population — personal income estimates conforming to the official OBE concept of the United States personal income and data available annually by States were developed for the Area and its sub-regions. Consistent estimates of employment and population were derived, including employment for major industries which are important users of water.

In developing measures for the future, we have started with the fact that the growth trend for the country has been at a fairly steady rate, cyclical variations and war periods aside. In consequence, the basic statistical evidences of expansion of national output and income have been employed as a benchmark.

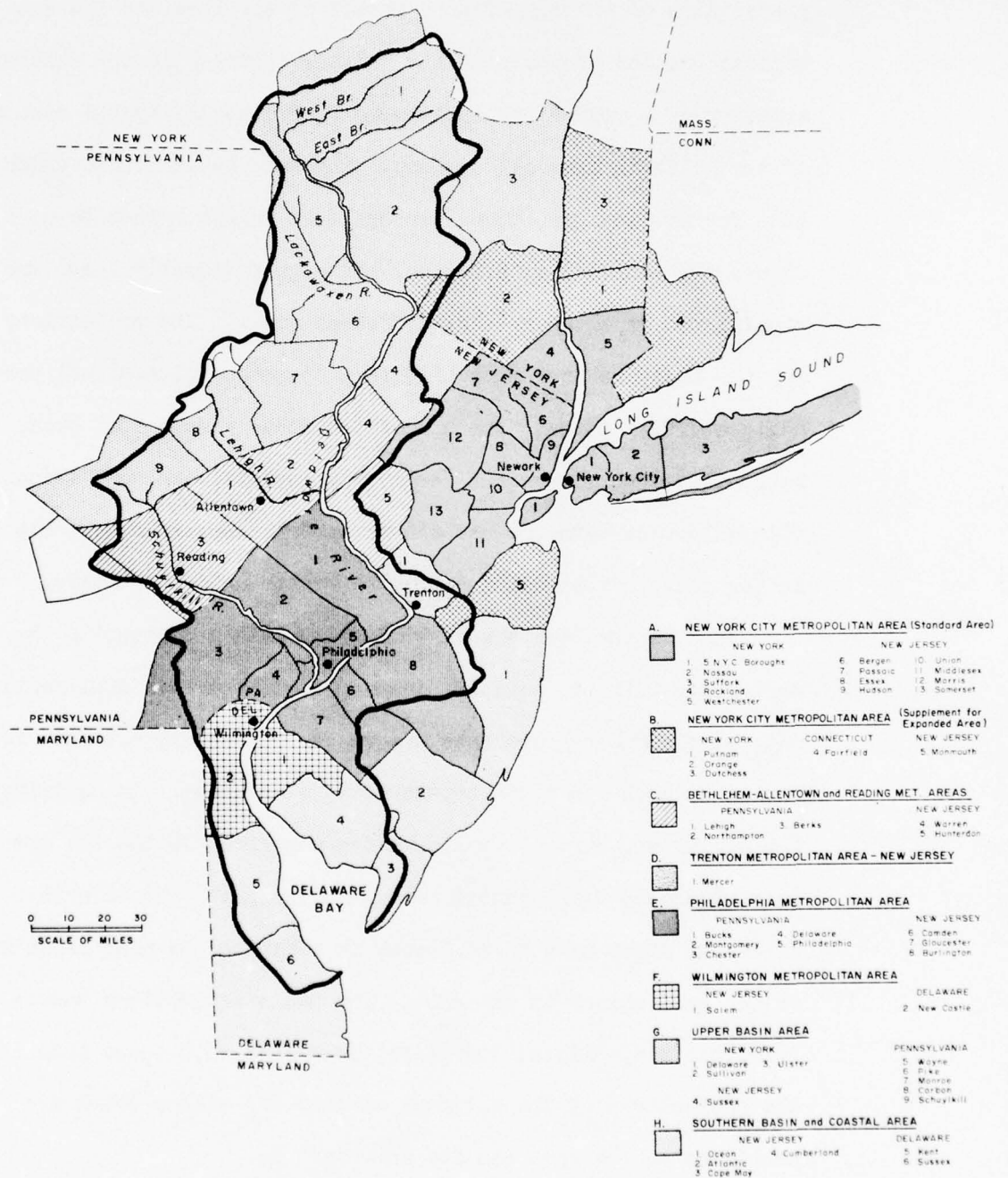
It would appear that such broad and inclusive measures of activity provide a reliable guide for estimating the overall expansion of water requirements, with personal income used on a regional basis since it is not feasible to apply the concept of gross output to parts of the country. While the general hypothesis stated above cannot be tested for past periods because of lack of sufficient historical data on water consumption, nevertheless it is clear that this relation must be quite close.

The 49 counties included in the Delaware River Service Area, and the groupings of these counties into the eight sub-regions as shown in the map, are in accordance with the definition provided by the Philadelphia District Engineer. The Area embraces not only the counties in the Delaware River Basin as such but includes other relatively nearby counties which are either present or potential users of the Delaware River waters. Availability of data was an important consideration in grouping the counties, and for this reason Standard Metropolitan areas were used wherever possible.



Figure 1

# Delaware River Service Area Counties and Sub-Regions



### Nature of Projections

A primary consideration in the development of the regional projections of the comparative growth of the Area and its sub-regions was the progress of the Nation. Changes in the economic activity of a region are influenced fundamentally by the course of the Nation's over-all economy. The same basic forces which make for national growth or for cyclical swings affect to some degree the activity of a region, although frequently there are significant departures among different areas. The projections for the Delaware Area were tied to projections of national economic activity through the use of the broad measures of gross national product, personal income, employment, and population, with allowance made for certain variant tendencies observable in the past in the relationship of Area to national totals.

Just as the Delaware River Service Area has grown in the past along with the national economy — though at a differential rate — the sub-regions have progressed at varying rates in relation to each other and to the national average. In deriving the estimates, careful consideration was given to the factors which produced differential growth in the past, and to such others as might have an influence in altering the past relations of the sub-regions of the Area. The basic assumptions underlying the projections, therefore, encompass both those made in the projections of the national economy and others which are pertinent to the Area and its sub-regions.

The estimates of future growth given in this report are not forecasts or predictions, although in our judgment they do represent reasonable estimates of growth which, under assumed conditions, may be utilized for the basic purpose of the water survey. They should be thought of not as precise figures for particular years, but as magnitudes that could be expected to prevail — at least for the nearer years — under conditions of generally full employment in which the Area would share in accordance with past performance and observed tendencies.

As an integral part of the procedure, it was important to ensure the maintenance of internal consistency among the various assumptions and projections. The projections were examined from various points of view and in relation to each other. For example, personal income projections were analyzed for their implication as to trends of per capita and per employee income, and the population projections were related to the population estimates.

To the extent practicable we consulted with various agencies — such as the Department of Interior, the Atomic Energy Commission, and the Department of Agriculture — to determine whether or not there were any knowable factors likely to be operative in the future which would materially influence the projections. Examples of such possible influences are changes in technology, new product developments which would have significant economic impacts, and major shifts in consumer demands.

This procedure was utilized so that all such factors might be considered specifically. In general, it may be said that the limited evidence adduced as to new factors or developments which might be forthcoming did not result in any important changes in the over-all analysis or projections, though it did modify specific parts.

In short, the estimates are derived from a series of realistic assumptions and from extensions of past trends and relationships. If the assumptions do not materialize, or if the relationships are altered in the future, then the actual developments could differ materially from those projected here.

The projections for future years are based on the fundamental assumption that the forces which have produced our dynamic, expanding national economy in the past will continue to exert a similar influence in the future on the total and its major parts. The gross national product in the past 50 years has increased at an average rate of 3 percent per year, and our simple assumption is that the forces operating now and in the period ahead should permit us to do as well in the future. All the projections, both nationally and regionally, are consistent with this result which we regard as a reasonable basis for programming for resource development.

It is not possible, of course, to foresee a full range of economic developments and changes which in the period ahead may modify the trends significantly. New production techniques



may produce results beyond those embodied in our calculations, and the introduction of new products may have a multiplier effect on demand beyond that implied in the assumptions of the present projections.

But such changes are part of our history, and their results are embodied in the Nation's past performance. It is difficult to discern in the historical growth of the national economy any discrete breaks, other than those associated with cyclical business movements or war periods.

Trends for the United States and the Delaware River Service Area as a whole provide a satisfactory basis for appraising the probable pattern of future developments, but for the sub-regions they are less reliable guides to the future. This is understandable if only because developments as they occur will have more of an impact on the smaller than the larger entity. Thus, in the history of particular geographic areas and industries discrete breaks are more visible than in the case of larger groupings or the Nation as a whole, and such changes may be expected to occur in the future.

The projections involve a span of about 50 years. The years 1965 and 1980 were selected as convenient intermediate points that are widely used by numerous private and public agencies in considering their long-term programs.

It will be necessary, of course, as time unfolds, to review these projections in the light of the actual economic trends as

they develop, and to make such modifications as may be indicated. Such re-evaluations might be made, for example, at 5-year intervals.

Both the sponsors of this Economic Base Survey and the Office of Business Economics have been mindful of the manifold uses to which these results may be applied. Depending upon the focus of interest, more specialized relationships may be derived for use in community and area development programs. These may involve local versus national market potentials or industrial growth, as well as the impact of business expansion upon local resources and facilities. The groundwork laid here for the extension of regional economic analysis in regard to the Delaware River Service Area may also prompt action of a similar nature in other regions for which as yet no such survey has been undertaken.

## SUMMARY REVIEW

The comparative growth of the United States and the Delaware River Service Area -- measured in broad terms of output, income, employment, and population -- is presented in detail in our report and projected for the period ahead in the first four tables. The major findings derive from analysis of the economic developments of the region in relation to the United States over an extended period of time, with the most intensive analysis centering on the past three decades.

The Office of Business Economics has developed growth trends for the past half century and more which show that the gross national product of the United States, an inclusive measure of output, has been expanding at an average rate of 3 percent per year -- equivalent to a doubling of production approximately every 23 years. This trend is illustrated in Figure 2 on page 21.

Most of this expansion can be traced to increased productivity, arising primarily from technological and managerial progress, a high rate of capital formation embracing in part the development of natural resources, a growing labor force, and constant advances in the education and skills of the working population. Shifting of the working force into activities in which productivity is greater has also contributed. So have the economies of large-scale production and increased division of labor associated with the growth of population and the market economy.

Operating in a favorable natural and institutional environment, these forces have brought an average annual advance of more than 2 percent in output per manhour in the economic system as a whole. Progress has been marked not only in manufacturing, mining, and agriculture, but also in transportation, distribution, and the manifold industries providing services to consumers and to other business enterprises.

The other factor in the growth of output has been the increasing number of manhours worked. Both population growth and the movement of women from housework to production for the market have contributed to this expansion. These influences on aggregate manhours have in the past been partially offset by the decision of Americans to take part of the gains of higher productivity in the form of shorter working hours rather than more goods and services.

Economic progress has not, to be sure, been steady or uninterrupted. Long-term forces have often, over shorter periods, been obscured or overridden by cyclical developments or wars. But we may expect that the same fundamental forces that have contributed to expansion in the past will continue to operate in the proximate future, though we may expect also a differential impact in particular parts of the economy. The latter has been the history of the past, and is entirely consistent with regular long-term growth of the general economy.



All of the projections in this report are based on assumptions of a high employment economy and, where dollars are involved, are stated in constant prices of 1957.

#### The Basic Pattern of Expansion

The past rate of progress in the national economy is an impressive one, and in the projections in this report we give a summary view of what is possible through carrying this progress forward.

The gross national product in 1957 amounted to \$442 billion. On the basis of the trend conforming to the historical pattern, the 1965 total is set at close to \$570 billion, rising in 1980 to around \$900 billion, and to more than \$2,000 billion fifty years hence. The personal income estimates consistent with the assumed growth pattern yield an implicit per capita purchasing power rising from about \$2,000 in 1957 to \$2,300 in 1965, to around \$2,900 in 1980, and for the terminal year of the study to a figure considerably more than double current average income, all expressed in terms of 1957 dollars.

The population projection in the body of this report may be regarded in general as a median expectation in line with the historical trend, taking into account for the earlier part of the period the most recent demographic tendencies. The national population is projected to rise from the 174 million of mid-1958 to over 190 million in 1965, to approach 250 million in 1980, and to continue to rise in the following quarter century.

The broad measure of activity represented by employment was developed in particular to assist in estimating industrial water requirements. Total employment in 1957 averaged 68 million (including armed forces), and we have projected for 1965 a figure in excess of 75 million, moving up to between 90 and 100 million in 1980; and for the terminal year of our study the 1965 total is approximately doubled.

As discussed in Chapter I, the output and income which we have projected could be achieved under conditions of some variation in the population and employment from the figures set forth in the accompanying table.

For the Delaware River Service Area, personal income is used as the most comprehensive available measure of economic activity. The average rate of growth of this broad gauge of national economic progress has also been 3 percent a year, and for this and other reasons it is well suited to the purposes of this report. Regional water use undoubtedly is related closely to this major indicator, although in the absence at this time of sufficient historical data the exact relationship cannot be established.

The Delaware Area has expanded at a high though variable rate in the past, including a large growth in the recent postwar period. The basic economic measure for the Area used in this report -- personal income -- amounted to \$58 billion in 1957. This was equivalent to about \$2,600 per capita -- one-fourth higher than the United States average.

UNITED STATES  
SUMMARY OF PROJECTIONS: 1965, 1980 AND 2010

	Actual						Projections			
	: 1955	1956	1957	1958 :	1955	1956	1957	1958 :	1965	2010
		(Bil. current dol.)			(Billions of 1957 dollars)					
Gross national product.....	397.5	419.2	442.5	441.7	425.5	435.3	442.5	431.8	570	2,300
Personal income.....	306.6	330.4	347.9	356.3	321.0	340.2	347.9	349.0	450	1,800
		(Current dollars)			(1957 dollars)					
Gross national product per capita.	2,405	2,492	2,585	2,537	2,574	2,588	2,585	2,480	2,900	6,200
Personal income per capita.....	1,866	1,975	2,043	2,057	1,954	2,034	2,043	2,014	2,300	4,900
		(Millions)			(Millions)					
Population.....	165.3	168.2	171.2	174.1					195	370
Number of households.....	48.0	49.0	49.8	50.6					57	117
Employment.....	66.2	67.8	67.8	66.6					76	151

The average annual rate of growth of personal income in real terms over the 1929-1957 period varied considerably among the sub-regions. The rate of increase for the entire Area was just over 2 percent per year, compared with the national average of 3 percent. The Trenton, Wilmington, and Southern Basin and Coastal Areas showed average or better-than-average experience. In the lower range percentage-wise was the great and highly developed New York Metropolitan Area, as well as the least developed sub-region -- the Upper Basin.

The projections of personal income for the Area and sub-regions are tied to the national projections of personal income but take into account the differential long-term trends. The DRSA personal income (in constant 1957 dollars) is projected to grow at a rate exceeding  $2\frac{1}{2}$  percent, reaching \$70 billion in 1965, \$100 billion by 1980, and to continue to expand in line with the trend to the terminal date of this survey. These figures compare to a \$58 billion income flow in 1957.

In 1957 the Area, which comprised about 13 percent of the total U. S. population, accounted for just under 17 percent of the total U. S. income. Translated into per capita terms the figures are as follows: For 1957, the base year used -- \$2,600; for 1965 -- \$2,800; for 1980 -- \$3,300; and for the terminal year of the study the 1957 figure may be doubled.

In the initial part of the historical period covered, the first



Table 2

DELAWARE RIVER SERVICE AREA  
SUMMARY OF PROJECTIONS: 1965, 1980 AND 2010

	: Actual	: Projections		
	: 1955	: 1965	1980	2010
(Billions of 1957 dollars)				
PERSONAL INCOME.....	53.7	70.0	100.0	224.0
	(1957 = 57.6)			
POPULATION AND HOUSEHOLDS (Thousands)				
Population.....	21,589	25,000	30,000	42,000
Households.....	6,499	7,400	9,100	13,500
EMPLOYMENT (Thousands)				
All industries.....	9,073	10,300	12,400	18,000
Commodity producing industries.	3,643	4,200	5,100	7,400
Manufacturing, total.....	2,907	3,400	4,200	6,100
Food & kindred products.....	215	230	270	400
Chemicals & allied products..	190	235	325	630
Petroleum & coal products....	65	75	90	145
Primary metal products.....	146	180	240	400
Paper & allied products.....	80	100	150	300
Noncommodity producing industries.....	5,430	6,100	7,300	10,600

quarter of the present century, the population of the Area grew more rapidly than that of the Nation as a whole. Since the 1920's the Area has continued to grow at a substantial rate, though -- in common with the entire highly developed northeastern portion of the country -- it did not match the national average. The comparative movements of the regional economies were influenced by accelerated expansion in the more recently developed areas of the South and West.

The past trends of Delaware Area population, taken in conjunction with projected economic activity of the region as measured by employment, indicate gradual population expansion for the Area from 21½ million in 1955 to 30 million in 1980, and to a figure for the terminal date of the Economic Base Survey not far from double that of 1955.

In the Delaware River Service Area, total employment rose 5.4 million from 1900 to 1955, to reach a figure in the latter year of just over 9 million. Our projections envisage a further expansion of about a third by 1980, with the 1955 total roughly doubled by 2010.

In 1955, employment in the Delaware Area was nearly one-seventh of the national aggregate. The 5.9 million employees in the New York Metropolitan Area, together with the 1.7 million in the Philadelphia Metropolitan Area, accounted for about five-sixths of the regional total.

Employment totals for the major industry groups have been separately calculated as a basic guide for use in evaluating probable industrial water use.

Table 3

DELAWARE RIVER SERVICE AREA  
SUMMARY OF PROJECTIONS OF PERSONAL INCOME  
FOR SUB-REGIONS: 1965, 1980 AND 2010

	: Actual	: Projections		
	: 1957	: 1965	1980	2010
(Billions of 1957 dollars)				
Delaware River Service Area.....	57.6	70.0	100.0	224.0
New York Areas, total.....	42.2	50.5	70.6	156.0
N. Y. City Metropolitan.....	39.3	46.7	64.4	139.0
N. Y. City Supplement.....	2.9	3.8	6.2	17.0
Delaware Valley, total.....	15.5	19.3	29.2	68.4
Bethlehem-Allentown-Reading....	1.8	2.2	3.3	7.8
Trenton Metropolitan.....	.7	.9	1.4	4.0
Philadelphia Metropolitan.....	10.1	12.1	17.8	39.5
Wilmington Metropolitan.....	1.1	1.6	2.6	7.0
Upper Basin.....	.9	1.2	1.8	4.0
Southern Basin and Coastal.....	.9	1.3	2.3	6.1

Table 4

## DELAWARE RIVER SERVICE AREA

## SUMMARY OF PROJECTIONS OF POPULATION AND EMPLOYMENT

FOR SUB-REGIONS: 1965, 1980 AND 2010

	: Actual	Projections		
	: 1955	: 1965	1980	2010
POPULATION	(Thousands)	(Thousands)		
Delaware River Service Area.....	21,589	25,000	30,000	42,000
New York Areas, total.....	15,072	17,500	20,500	28,400
N.Y. City Metropolitan.....	13,851	16,000	18,500	25,000
N.Y. City Supplement.....	1,221	1,500	2,000	3,400
Delaware Valley, total.....	6,518	7,700	9,500	13,350
Bethlehem-Allentown-Reading....	798	900	1,100	1,550
Trenton Metropolitan.....	250	300	400	650
Philadelphia Metropolitan.....	4,121	4,800	5,800	7,900
Wilmington Metropolitan.....	329	450	600	1,000
Upper Basin.....	551	650	750	950
Southern Basin and Coastal.....	469	600	850	1,300
EMPLOYMENT	(Thousands)	(Thousands)		
Delaware River Service Area.....	9,073	10,300	12,400	18,000
New York Areas, total.....	6,392	7,200	8,600	12,400
N.Y. City Metropolitan.....	5,897	6,600	7,800	11,000
N.Y. City Supplement.....	495	600	800	1,400
Delaware Valley, total.....	2,681	3,100	3,800	5,620
Bethlehem-Allentown-Reading....	357	400	470	700
Trenton Metropolitan.....	110	130	170	280
Philadelphia Metropolitan.....	1,671	1,910	2,300	3,300
Wilmington Metropolitan.....	136	180	240	420
Upper Basin.....	214	240	280	380
Southern Basin and Coastal.....	193	240	340	540



EXPANSION

of the

AMERICAN ECONOMY

A principal feature in the record of regional progress in the United States economy is the role played by national developments. While individual areas evidence a high degree of specialization -- in heavy or light goods production, in farming, in foreign commerce, in financial transactions -- the economies of the various regions are highly interdependent. They are linked to each other by a complex network of commodity and service flows, producing a single national economy comprised of complementary interrelated parts.

When a specific national development is clearly pronounced and sustained over a period of time, its influence is generally transmitted in force to all areas of the Nation. It has not been possible, for example, for any one region to escape the impact of major cyclical swings in general business activity.

The most pervasive of all long-term developments affecting the national scene has been without doubt the persistent and strong growth tendency of the economy. All areas of the Nation

have participated in this phenomenon -- some in greater, some in lesser degree. Development of regional resources in turn has been one of the prime factors in the progress of the national economy.

It is the foregoing central facts which dictate the approach adopted in this report for evaluating the economic potential of the Delaware River Service Area. The strongly held presumption is that growth will continue to be a feature of the American economy over the next half century, and that the Area will share in the overall expansion. While its share will depend, no doubt, on some factors which cannot now be foreseen, the record of the past suggests fairly well defined trends in the relationships existing between this region and the Nation. With due allowance for special factors which have been at work, there is reason to expect that these past trends may be projected into the period ahead.

This basic approach makes imperative an understanding of

- (1) the principal features of national growth in the past, and
- (2) the extent to which the Delaware River Service Area has shared in this growth. Chapters II and III will cover the latter aspect, as well as the future potential of the Area's development.

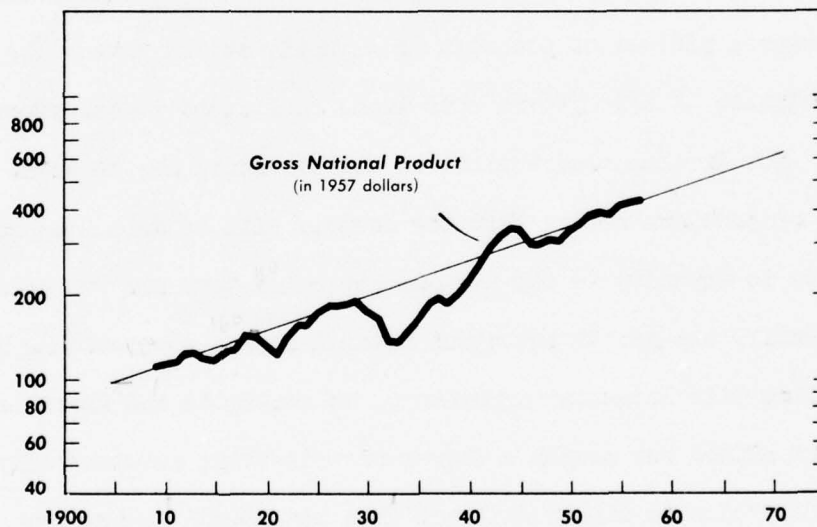
This chapter first depicts national expansion over the past 25 to 50 years. It then sets forth the dimensions of the United States economy over the next half century on the assumption that

Figure 2

## The Economic Growth of the United States

has averaged 3 percent a year

Billions of Dollars (ratio scale)



U. S. Department of Commerce, Office of Business Economics

Data: See Table 5 & App. Table 1

the rate of progress is extended. Projections based on a study of past national trends cannot be regarded as forecasts; they do, however, provide a meaningful framework within which national or sectional progress and growth potentials can be assayed.

It must be stressed at the outset that the broad sweep of national growth represents a composite result evolving from shifting and at times highly variable influences which have been the historic feature of our dynamic free market economy. Abstracting from these temporary and changing phases of development, there emerges a picture of progress at a fairly steady rate. The very steadiness of this growth rate lends confidence to our procedure.

Two further observations on the procedure may be made. First, our projections assume that the economy will be operating at or close to capacity in the periods for which they are provided. Secondly, the growth potential assumed in the projections, being in line with long-term experience, is realistic and feasible and would afford our people a degree of well-being substantially higher and more widely diffused than the record achievement of recent years.

#### Measures of Progress

On the national level, the most comprehensive measure of output is the gross national product. This represents the sum total of goods and services produced in the economy expressed



in terms of market values. For purpose of analyzing growth trends, it is necessary to remove from this measure the effect of changing prices. The resulting "constant dollar" figures thus represent changes in the real or physical volume of goods and services.

Gross national product estimates are not available on a regional basis. However, an alternative comprehensive series -- personal income -- is available. This has proved to be an excellent measuring rod of regional developments, showing as it does the income flow to individuals from all sources.

For purposes of this survey, special estimates and analyses of personal income were prepared for the Delaware River Service Area and its sub-regions. It is thus possible to relate the trends for the Nation to the movements of real personal income for particular areas, such as the Delaware.

The Office of Business Economics estimates of constant-dollar GNP and personal income permit a tracing of national economic activity over a half-century span. These establish an average annual growth of 3 percent -- a rate which prevailed not only for the half-century as a whole, but also for the first 20 years and for the past 3 decades as well. The picture is set forth in Figure 2.

It is worth stressing that we refer here to secular, or long-term, expansion. Over the short-run, the economic momentum has not been even. This fact is brought out in the chart which

portrays the fluctuations of constant-dollar GNP in relation to the basic growth trend.

Our analysis will focus mainly on developments since 1929, the period for which statistical information on total output is most complete and reliable. We thereby have a time span sufficient for long-term perspective and analysis of growth.

It may be noted in passing that the more we travel back into history, the greater chance exists that comparisons may be unduly affected by conditions not entirely relevant to the present or to projections into the future.

Take, for example, the degree of industrialization as mirrored in the shift from farm to nonfarm activities. A century ago urban families made up less than one-fifth of the total population. By the late 1920's, the ratio had risen to somewhat less than three-fifths. In the succeeding three decades, however, urbanization slowed considerably and today the urban population is slightly above the 60 percent mark.

Although we may expect some further relative expansion in urban population, it is very unlikely that the pace of change would be comparable to that of the 19th Century, it is more likely to resemble the changing environment as evolved in the last several decades.

Table 5

UNITED STATES  
GROSS NATIONAL PRODUCT, PERSONAL INCOME, EMPLOYMENT,  
AND POPULATION -- HISTORICAL DATA

Year	Gross National Product	Personal Income	Employment (Annual av.)	Population (July 1)
	(Billions of 1957 dollars)		(Millions)	(Millions)
1870	--	--	--	39.9
1880	--	--	--	50.3
1890	--	--	--	63.1
1900	--	--	--	76.1
1910	113.1	--	--	92.4
1920	133.3	--	--	106.5
1929	193.9	144.4	47.9	121.9
1930	175.3	135.7	45.7	123.2
1940	221.9	165.3	48.1	132.1
1941	258.2	188.9	52.0	133.4
1942	297.9	215.9	57.7	134.9
1943	327.4	240.1	63.5	136.7
1944	351.5	245.1	65.4	138.4
1945	345.5	242.7	64.2	139.9
1946	305.4	240.4	58.7	141.4
1947	305.0	233.5	59.6	144.1
1948	316.6	242.7	60.8	146.6
1949	316.5	243.4	60.3	149.2
1950	343.4	263.7	61.6	151.7
1951	370.8	277.1	64.1	154.4
1952	384.2	288.7	64.9	157.0
1953	401.4	300.6	65.8	159.6
1954	393.9	300.0	64.6	162.4
1955	425.5	321.0	66.2	165.3
1956	435.3	340.2	67.8	168.2
1957	442.5	347.9	67.3	171.2
1958	431.8	349.0	66.6	174.1

## National Output and Income

Measured in 1957 prices, gross national product grew from 194 billion in 1929 to \$443 billion in 1957, an increase of \$249 billion, or 128 percent. As we have stated earlier, a similar rate of growth was evident in the 1909-1929 period. This impressive expansion of output and economic well-being was the product of a growing population and labor force, increased availability of natural resources and capital, and improvements in technology, managerial efficiency, and workers' skills.

The Nation's population reached 171 million in 1957. This is almost 50 million, or 40 percent, more than at the end of the 1920's, and compares with a population of less than 90 million a half century ago. There were corresponding increases in the labor force and in employment, with the latter rising from 48 million persons in 1929 to almost 68 million in 1957.

Per capita gross output amounted to \$2,585 in 1957. Measured in dollars of comparable purchasing power, output per person was \$1,590 in 1929.

Since relative growth has been less in population and employment than in total production, it is clear that a major aspect of our improved standard of living has been a sharp expansion in output for a given input of effort. This increase in productivity lies at the heart of our economic progress.



## Use of Production Factors

In a major sense it is not possible to quantify the vast array of underlying factors -- many intangible -- which have contributed to growth in the economy. Indirect evidence clearly points to the great importance of some of these. For example, the proportion of our population attending school has increased significantly. In addition, specialized training in production and management problems has been stepped up greatly, and both industry and government have vastly expanded their programs of research and development.

Without doubt a major influence in the increasing well-being of the people has been emphasis placed by American business on the use of capital equipment. A special study by the Office of Business Economics of the relative changes in inputs of labor and capital in the production of manufactured goods helps to highlight the cooperative nature of the productive process. Manufacturing output in 1957 was two and one-half times that of 1929 -- a gain, it may be noted, considerably larger than for the economy as a whole. In the achievement of this expansion, total hours worked in manufacturing increased by 40 percent. At the same time, however, services supplied from capital invested in this industry were virtually doubled.

This picture would no doubt be similar for other industries if adequate information were available to tell the story. There would, of course, be variations in the relative contribution of

labor and capital to the expansion of output but the cooperative aspect involved in the process of growth would stand out in relief. This point must be borne in mind in considering future growth of the economy. An increase in both manpower and capital will be necessary to achieve in the future a record of growth comparable with that of the past.

#### Projection of the National Economy

In the light of this record of growth, what is the national potential for the period ahead?

In making projections of the size of the American economy, OBE is carrying on work that has been done in the past for more limited periods. In Markets After the War<sup>1/</sup> we established in 1943 the size of the market that could be expected in the postwar period. This was generally recognized as a helpful guide for both business and government. At the suggestion of the Committee for Economic Development to the Department, a similar study looking towards the end of the Korean hostilities was made in 1952, and published under the title, Markets After the Defense Expansion.<sup>2/</sup>

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<sup>1/</sup> U. S. Department of Commerce, Markets After the War, printed as Senate Document No. 40 (78th Congress, 1st Session), U. S. Government Printing Office, Washington, 1943.

<sup>2/</sup> U. S. Department of Commerce, Markets After the Defense Expansion, U. S. Government Printing Office, Washington, 1952.

The present report extends our projections over a much longer period of time since the Corps of Engineers established a requirement for a broad approximation of development of the economy looking toward the turn of the next century. This was stated to be needed for certain programming aspects of river development. In going this far, all recognized the limitations that are inherent in trying to peer so far into the future. But on the basis of the assumptions of growth established for guide lines in the study, we have determined broad magnitudes for the longer period established as one of the benchmarks by the Corps of Engineers. (Table 1.) It was generally agreed that the estimates for the intermediate years would serve a variety of purposes, not only in connection with the Delaware water survey, but for other economic purposes as well.

Looking at the projections for the more proximate years, we find that -- abstracting from cyclical variations and changes in prices -- gross national product would reflect an increase in output of about three-fifths by 1965 and a doubling a quarter of a century hence.

The potential advance in the Nation's standard of living may be seen in the calculated rise in per capita personal income earlier set forth in the summary of this report, and detailed in the tabular presentation of projected growth. By 1980, the figure would represent an increase of more than one-half.

Employment would be greatly increased if these potentials are realized. We place the number of persons at work in 1965 in excess of 75 million compared with 68 million in 1957, and by 1980 employment could be some 25 to 30 million above recent levels. (Table 6.)

It might be noted that our projected employment represents but one of several patterns consistent with an overall growth rate of 3 percent. For example, a rise in productivity greater than that which has occurred in the past would permit achievement of the projected gross national product with a lesser increase in manpower requirements and a correspondingly greater amount of leisure time for the population. On the other hand, should future productivity not keep pace with the measured trend, the output projection nonetheless could still be achieved through a different pattern of utilization of the labor potential.

To arrive at the employment projections actually used, reliance was placed on past relationships of labor force participation of the population. Labor force and employment were assumed to rise in line with the larger population, with due allowance for what appear to be long-term tendencies at work in the economy.

With respect to the population projections themselves, the range of possible estimates is widened as the period under consideration becomes more remote. For the longer-term view, past history has provided numerous instances where population projections have been rendered invalid by shifts in underlying factors determining growth.



Table 6

## UNITED STATES

## EMPLOYMENT PROJECTIONS BY INDUSTRIES: 1965, 1980 AND 2010

(Thousands)

	Actual		Projections		
	1950	1955	1965	1980	2010
All industries, total.....	61,607	66,242	76,000	97,000	151,000
All commodity producing industries, total.....	28,394	29,168	32,300	39,200	59,000
Manufacturing, total.....	15,814	17,121	20,100	26,100	42,500
Food & kindred products....	1,557	1,531	1,710	2,100	3,200
Chemicals & allied products	688	804	1,050	1,570	3,300
Petroleum & coal products..	310	315	360	450	700
Primary metal industries...	1,252	1,329	1,560	2,020	3,300
Paper & allied products....	498	554	710	1,040	2,100
All noncommodity producing industries, total.....	33,213	37,075	43,700	57,800	92,000

For the most part, difficulties in the way of population projections for the United States arise from changes in fertility rates. Mortality statistics have pointed to a fairly well defined pattern of moderate and steady improvement in the life span, and net immigration trends may be assumed on the basis of what appear to be fairly predictable national policies in this respect.

Though there is a wide range of possibilities in population growth, it may be noted that the effects of variation on the output projected in this report are not likely to be nearly so great as might be implied. This consideration stems from the fact that the size and composition of the labor force -- and hence the level of projected employment -- over the next several decades will be determined in large part by the number and age of persons now living. Changes in fertility rates might, therefore, affect the total population to a much greater extent than they would the labor force or employment.

A word might be added concerning the longer-term population projection. The figure that we have used is roughly in line with past long-term developments, and may be thought of as a median number. While some may regard it as conservative, the estimate has a primary advantage, we feel, for growth projection purposes in that moderate deviations can be tolerated within the range of possible variations in other economic developments. Thus, a somewhat lower (or higher) population estimate could eventuate, yet

be offset in economic impact by a higher (or lower) intensity of operations not out of line with past experience. Use of more extreme projections would involve more tenuous alterations in other variables in the light of the experiences of the past.

## STRUCTURAL CHANGES IN THE ECONOMY

The foregoing section has pointed up the tremendous growth potential of the United States economy, showing the progressively expanded economic dimensions of the Nation, given a state of future progress promised by past performance and the technological horizon.

At this point it might be helpful to refer once more to the background of the past, several features of which have relevance for expectations concerning future growth.

Growth in the last half century has been accompanied by pronounced shifts in the disposition of output among broad groups of users and in the industrial composition of production. The proportionate shares of gross national product absorbed by today's purchases of consumers, business and government differ significantly from those of 25 years ago, as well as from those prevailing in the early part of the century.

Government has greatly increased its relative share of output; this has been reflected in a reduced proportion going directly to consumers -- a reduction accomplished through increased payment of taxes. The government outlays, of course, have in part benefited consumers directly, as in the case of schools. Farm output, while up substantially, has not kept pace with the overall trend. Other industrial changes have likewise been far-reaching, and of varying intensity at different stages of development.



Yet despite these underlying shifting patterns of demand and supply conditions, the economy maintained a steady long-term rate of growth not only for the earlier years of the past half century but for more recent intervals as well. Short-term variations were at times temporarily discouraging, as in the depression of the 1930's, or beyond even optimistic expectations as in periods of war emergencies. Particular note should be directed to the variability of these short-term developments in order adequately to assess the deviations from trend in the light of more permanent forces in operation.

#### Expanded Role of Government in Economy

The principal shift in demand forces over the past quarter century has centered in the greatly expanded role of government. Total government outlays for goods and services amounted to over \$86 billion in 1957, or 20 percent of gross national product. These expenditures were more than four times those of 1929 in dollars of constant purchasing power. The sharp increase in government's share of total output between 1929 and 1957 was far more striking than that for the two preceding decades when government expenditures in real terms rose from 7 percent of GNP in 1909 to 10 percent in 1929.

Virtually all of the increase in the relative importance of government demand since 1929 has stemmed from enlarged national security requirements. Total Federal expenditures on goods and services amounted to \$50 billion in 1957, compared with a little more than \$1 billion in 1929. Of the 1957 total, \$45 billion -- or 90 percent -- came under the heading of national security, and these outlays were equivalent to 10 percent of aggregate national output.

Civilian-type functions of government -- at the Federal, State and local levels -- claim at the present time a share of gross national product not significantly different from that taken a quarter of a century ago. By far the major part of these functions is supplied by State and local governments, whose combined expenditures on goods and services are equivalent to 8 percent of the total.

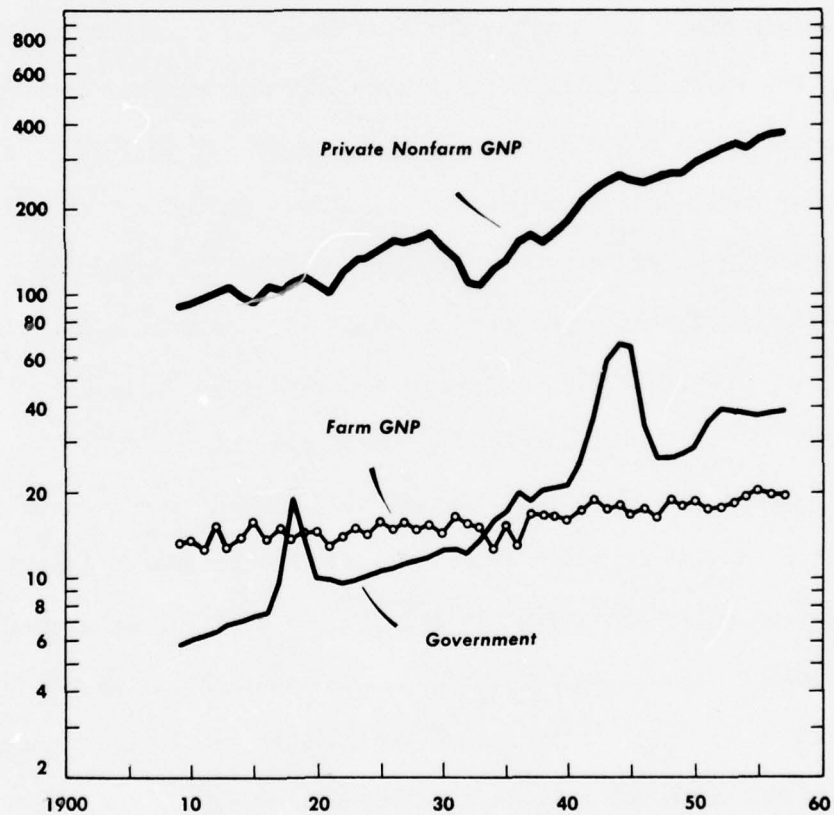
#### Consumer Market Dominant One

While by far the most significant change over time in the structure of demand has been associated with the performance of government, the consumer is still the dominant force in the market place. In 1957, close to two-thirds of total output was channeled through consumer markets to satisfy the everyday needs of our population and to add to the general well-being.

Figure 3

## Expansion in Major Segments of the Gross National Product

Billions of 1957 Dollars (ratio scale)



U. S. Department of Commerce, Office of Business Economics

Data: See App. Table 2

The consumers' share was down somewhat from 1929, as a counterpart of the enhanced role of government. The transfer of resources involved in the relative shift from direct consumer purchasing to government services was accomplished through a sharp increase in Federal revenues -- from a 2-1/2 percent equivalent of GNP in 1929 to 13 percent in 1957.

Structural changes were also evident within the broad range of consumer demands, yet given the vast magnitude of long-term growth perhaps the outstanding feature of consumption patterns was the tendency toward stability. Expenditures for consumer durable goods amounted to 9-1/2 percent of GNP in 1957 -- a slightly higher ratio in real terms than in 1929. In dollars of constant purchasing power, consumer spending on services accounted for 24-1/2 percent of aggregate output in 1957, a moderately lower portion than in 1929. Buying of nondurable goods fell from about 35 percent of GNP in 1929 to 32 percent in 1957.

The share of consumer demand was reduced to a somewhat greater extent in terms of dollars of the current purchasing power actually prevailing in 1929 and in 1957. Thus measured, all major markets -- for durable and nondurable goods and for services -- felt the impact of the relative shift in consumer spending, although durable goods demand expanded at a somewhat faster pace than demand for nondurables and services.

It must, of course, be re-emphasized that over this period, real consumption -- both in the aggregate and on a per capita basis -- expanded sharply. Total real consumption gained at



an annual rate of 2-3/4 percent. It should also be noted that while the pace of consumer demand in total and for major groups was steadily upward, the more detailed types of product and service requirements varied substantially over the years. Thus, for example, expenditures associated with use of the automobile rose at a rate much above average, whereas consumer expenditures for clothing and related items increased at a less-than-average pace.

#### High Investment Fosters Progress

Possibly the most important single influence contributing to the expansion of average well-being in the Nation has been the persistent long-term growth of the Nation's stock of capital goods. We have noted earlier, for example, that capital in manufacturing doubled from 1929 to the present.

The process by which the Nation adds to its supply of fixed equipment involves, on the one hand, heavy investment demand by business firms and, on the other, savers providing a flow of purchasing power which is channeled to the capital markets.

While in the short-run business investment demands have tended to be rather volatile, over the long-run investment and saving have evidenced a tendency to remain in a fairly stable relationship to total output. This is a factor of special import to the Delaware region, which has been and gives promise of continuing to be an important supplier of the Nation's capital requirements.

Demand for new plant and equipment by business was \$47-1/2 billion in 1957 -- a record both in terms of current dollars and in dollars of constant purchasing power. These outlays represented nearly 11 percent of gross national product, a proportion of roughly the same order of magnitude as in 1929 and 1909.

Aggregate fixed investment demand has changed little relative to the total over the long-term. Substantial differences have occurred in the composition of this demand. Most striking has been the tendency for business firms to increase emphasis on new equipment; expenditures for plant facilities have risen at a slower rate, a feature of the intensified use of machinery and equipment in our recent economic development.

#### Patterns of Industrial Activity

Changes in market demand just reviewed have their counterparts in the industrial composition of output. This is conveniently summarized in the pattern of income as it originated in the various industries.

Reflecting the already described expansion, income derived from government -- consisting of the earnings of employees -- rose from about 6 percent of national income in 1929 to 10-1/2 percent in 1957. There was an offsetting reduction in the relative share of income earned in farming over this period as farm activity rose at a less than average pace. Income generated

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on the farm contributed roughly 9-1/2 percent to total national income in 1929, compared with about 4-1/2 percent in 1957.

This relative shift from farming activity, as alluded to previously, has been proceeding steadily for many generations. The decline actually involved a movement to urban areas and industrial occupations resulting in a reduction in the number of farm families. After allowance for this trend, the average well-being of the farm population has been relatively well-maintained.

The varying pace of government, farm, and nonfarm activity is depicted in gross national product terms in Figure 3. It may be noted that the trend in activity for the private nonfarm sector of the economy broadly traces the same pattern as that for the economy as a whole.

As measured by the industrial breakdown of national income, basic changes have occurred within the private nonfarm economy. In summary fashion, here are the more significant:

(1) Income originating in manufacturing has risen relative to the total, from about 30 percent in 1929 to 37 percent in 1957. This is a continuation of the trend under way since the start of the process of industrialization of the economy.

Broadly speaking, the gain in manufacturing reflected the increased importance of durable goods production -- basic metal, machinery, automobiles, and aircraft --

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although such rapidly growing industries as chemicals and paper products also contributed to the higher than average growth of manufacturing activity.

(2) In contrast to the relative gain in manufacturing, the share of income earned in finance and in transportation fell substantially, from 17 percent and 9 percent, respectively, of total private nonfarm income earned in 1929 to 11 percent and 6 percent in 1957. The decline in finance reflects in major part the lagging tendency in rental and interest incomes. The reduced share of income associated with transportation activity reflects for the most part the loss in relative position of the railroads, which have seen traffic diverted not only to other business types in the field but also to the passenger car owner who has increasingly tended to use his own rather than the common carrier mode of travel.

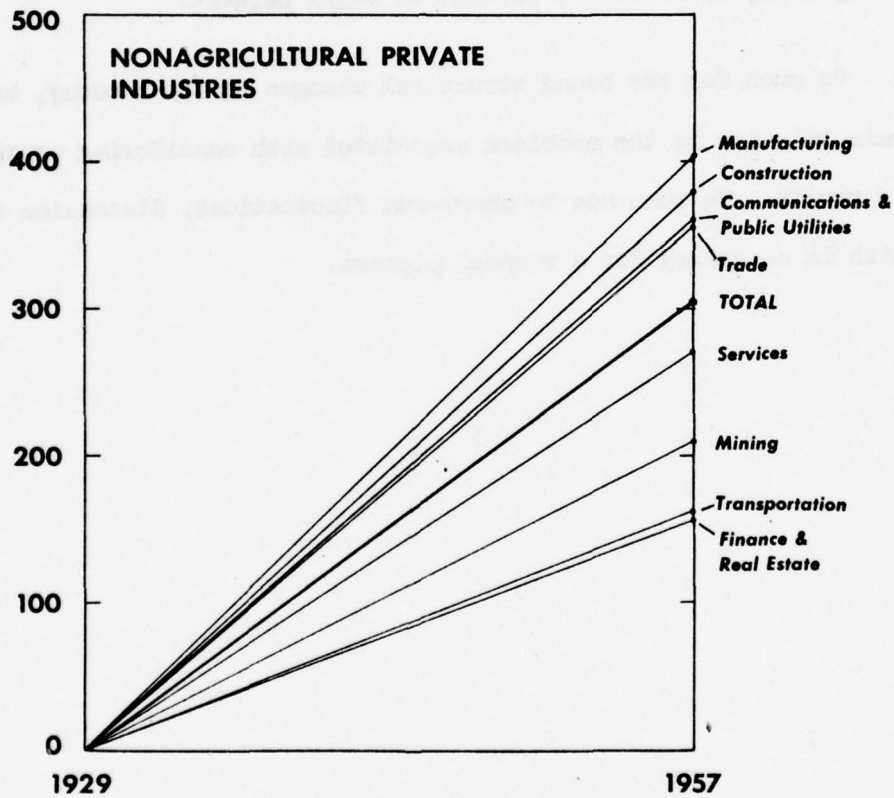
(3) Among other groups, the shifts in relative shares of income were not so striking. The distributive industries -- retail and wholesale trade -- show a moderate gain from 1929 to 1957. Combined this group provides one of the largest flows of income in the economy, accounting for one-fifth of the total originating in the private nonfarm sector.



Figure 4

## Growth of National Income By Industry

Percent Increase, 1929 to 1957



U. S. Department of Commerce, Office of Business Economics

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The service industries -- exceeded in size only by manufacturing and trade -- accounted for one-eighth of the private nonfarm total in 1957. This compared with a fraction of one-seventh in 1929.

The communications and other public utility groupings moderately expanded their activity over this same period, from about 4 percent to 4-1/2 percent.

So much for the broad structural changes in the economy, and their relation to the problems associated with considering prospects for growth. We turn now to short-run fluctuations, discussion of which is necessary for a rounded picture.

## SHORT-RUN VARIABILITY IN OUTPUT -- A CAUTION

Having stressed the even pace of long-term growth in the economy despite major structural changes in activity and demand, we feel that some caution is necessary with respect to the swings in activity which may occur over the short-run. Of prime importance in assessing future trends is the recognition of the variability of these short-term changes, and hence of the inadvisability of placing special emphasis on such changes for the long-term sweep of events.

This caution does not have direct relevance to programming of resource development requiring a long period for fruition, but it is significant in relation to other uses to which this base survey information may be put.

Wide variations in short-term activity were most notably associated with wars, severe depressions, and the subsequent recoveries. By way of example, during the 1930's there was virtually no net increase in real GNP. On the other hand, production expanded at exceptional rates during World Wars I and II.

The impact of the earlier of these conflicts on the economy was comparatively short-lived and not so striking as in the case of the second World War. When we entered World War I the economy was operating at a high rate with little slack in available utilization of resources, and the growth in total output was far less than the longer and more extensive mobilization of World War II.

Prior to December 1941, substantial excess capacity existed, and as the war continued pressures mounted to expand output well beyond normal limits. These facts explain the virtually unprecedented effort which was called forth. During this period, extending from 1939 to the peak of the war effort in 1944, total output of goods and services rose at an exceptionally rapid rate.

Other fluctuations may be noted in Figure 2. Production expanded at a moderate pace from 1909 to 1913, receded temporarily in 1914-15, and again moved forward up to the entry of the United States in World War I. Following this conflict there was a sharp contraction in 1920-21 far greater than any in the post-World War II period. But recovery from this recession was rapid and production moved higher with but minor interruptions from 1922 to 1929.

#### Developments of Past Decade

The period subsequent to 1945 may be thought to provide us with a fairly up-to-date picture of expansion which could help in assessing the long-run prospect. However, a brief review of postwar developments will highlight the fact that this period is probably not only too short an interval for the study of growth, but it was affected by exceptional circumstances which are not especially relevant in analysis of the more permanent forces at work.



One of the outstanding features of the last decade was the almost continuous pressure toward expansion. Except for brief intervals -- shortly after the end of World War II, during 1949, 1954, and 1958 -- the labor force was employed as fully as feasible for a highly dynamic economy. Over most of this period inflationary forces stemming in part from the war and in part from subsequent developments engaged attention. Rising prices and incomes, buttressed by exceptional liquidity conditions which followed from wartime restrictions on normal spending habits, provided a general setting of prosperity which was conducive to forging ahead to new highs. But note that even in such conditions expansion was far from uniform in the various segments of the economy.

After a temporary let-up as the war ended and reconversion got under way, output expanded sharply in 1947 and 1948. Growth was interrupted in 1949 but again resumed in 1950 and accelerated in the period of Korean hostilities.

With almost no interruption the economy shifted from the pressures of this conflict to more normal demands, and output reached new peaks in 1953. Following the short-lived recession of 1954, expansion was resumed and maintained up to the cyclical peak of the summer of 1957. The subsequent downturn was again brief and by early 1959, the economy had moved on to new high ground.

Throughout this period the pace of activity varied from small year-to-year declines in 1949, 1954, and 1958, to expansion exceeding for particular years the "normal" long-term growth. This performance was not unique, nor is it inconsistent with the steady growth pattern over time.

For the postwar period as a whole, the expansion of output was well above the long-term "normal," but is figured from a relatively low base. Most of this better-than-average rate of gain occurred in the highly special circumstances of the first part of the period, when reconversion was accomplished and backlogs of business and consumer demands were worked off.

It was only during the second half of the period, when the demands were filled and other special influences inherited from the great depression and the war years had largely spent their force, that the economy moved on a path more consistent with long-term trends.

#### From National to Regional

It is from this general review of the national economy that we proceed to an analysis of the Delaware Area and its sub-regions. How has this Area fared over time, and to what degree are variations from the national pattern evident? What is the potential of this large region, constituting one-sixth of the entire national economy? The answers have been set forth in Chapter II, the underlying material for which has been developed especially for the purposes of this report.

PAST AND FUTURE ECONOMIC GROWTH

of the

DELAWARE RIVER SERVICE AREA

The economic potential of the Delaware River Service Area as depicted in this chapter is the product of the interaction of regional trends and national developments. It was arrived at through a two-stage procedure.

The first stage required a projection of the volume and composition of economic activity that would be expected to prevail nationally under given assumptions. This national pattern exerts a major influence on the level of regional economic activity. Developments in the United States economy over the past half century were discussed in the preceding chapter in order to establish the basis of the national projections.

The second part of the projection technique adopted required an estimate of the share of the national economy represented by the Delaware River Service Area at specified future times. We felt that such an estimate for the future could best be derived through careful study of past changes in the Area's

economy, including detailed analysis of shifts in the sources of income both by industry and by type.

Analysis of historical shifts in the proportion of gross national product received in the Delaware Area since 1929, or even earlier, would have afforded treatment of the Area parallel to that given the Nation. But, as we have already noted, a measure of gross national product is not available on a geographic basis; nor is it feasible to construct such an aggregate for local areas.

Personal income, however, can be measured geographically, and a close and generally constant relationship between that series and gross national product has prevailed over the long run. In particular, it has been found that personal income nationally exhibits the same 3-percent average annual growth rate that characterizes the secular trend of gross national product. It is on the basis of this relationship that the income received by persons offers a link whereby the rate of economic growth in the Nation can be tied to that of an area, both historically and for the future.

#### The Personal Income Measure

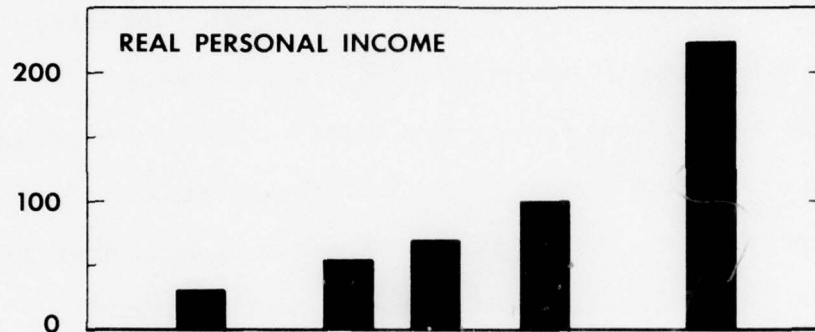
Personal income is thus the major tool used in describing the economy of the Delaware River Service Area. It is the most comprehensive measure of economic activity which can be prepared on a geographic basis, and provides an excellent yardstick for charting an area's growth.



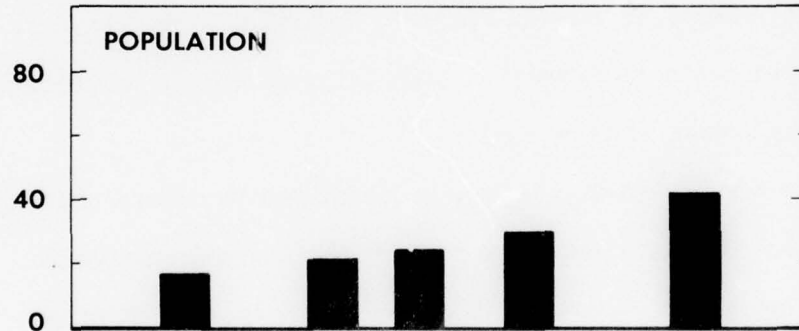
Figure 5

## Delaware River Service Area Economic Dimensions—Past and Projected

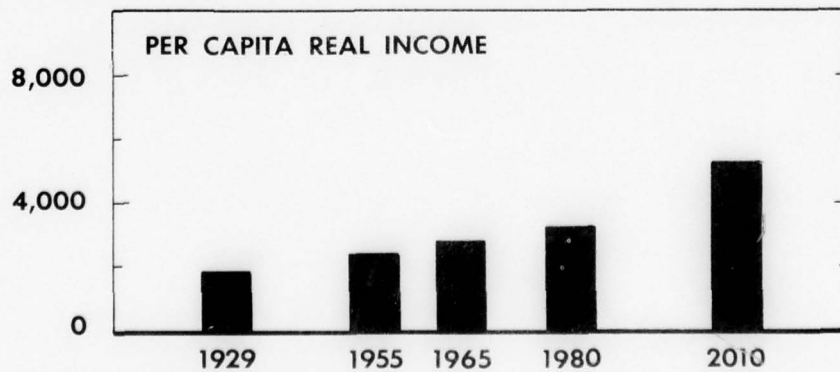
Billions of 1957 Dollars



Millions



1957 Dollars



U. S. Department of Commerce, Office of Business Economics

Data: See Tables 8, 10, 11, & 12

Personal income is the current income received by residents of an area from all sources. It is measured before deduction of income and other direct personal taxes, but after deduction of individuals' contributions to social security, government retirement, and other social insurance programs. It covers the income received by residents of an area from business establishments, Federal and State and local governments, and other sources.

All forms of income flowing to persons are included -- wages and salaries, various types of supplementary earnings termed "other labor income", the net incomes of owners of unincorporated businesses (including farms), net rental income, dividends, interest, and government and business "transfer payments" (consisting in general of disbursements to individuals for which no services are rendered currently, such as unemployment benefits, relief, and veterans' pensions).

The comprehensiveness of the personal income measure is evident also through comparison with population and employment. Unlike these latter measures, it reflects the average earnings (including productivity) of the labor force, returns on investment, and transfer payments. Personal income, it is clear, qualifies as a broad gauge both of economic activity and consumer purchasing power.

Official estimates of personal income by States are prepared annually by the Office of Business Economics, in a record now extending back to 1929. These are set forth in a major

report published as a special supplement to the Survey of Current Business.<sup>3/</sup> This volume contains a complete and detailed description of the State series, covering concepts, definitions, and methods of estimation, as well as a large amount of statistical information on sources of income in each State. However, this official series does not encompass estimates for local areas or geographic segments smaller than the State.

Accordingly, in order to obtain a personal income series for use in the economic survey of the Delaware River Service Area, we constructed a set of special estimates. Their preparation was a complex and technical job requiring considerable time and personnel, with much effort expended in assembling the maximum amount of reliable statistical information feasible. In this task, we were aided materially by the generous cooperation of numerous State agencies. Their assistance permitted the exploitation of many local sources of information which, because of their number and distance from Washington, otherwise could not have been utilized.

The personal income figures used in this survey, then, are special estimates designed to serve as an analytical tool in projecting the Area's economy into the future. Because they are being made available for the first time as part of this economic study, the following principal facts concerning them are set forth.

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<sup>3/</sup> Charles F. Schwartz and Robert E. Graham, Jr., Personal Income by States Since 1929, U. S. Government Printing Office, Washington, 1956.

(1) The primary aim in preparing the personal income estimates was to obtain information on the Service Area. However, within States, the county is the primary unit for which local-area statistical data are generally collected. In view of this, we made estimates of personal income on a county basis and then grouped them according to the 8 sub-areas of the Delaware delineated in the map on page 3.

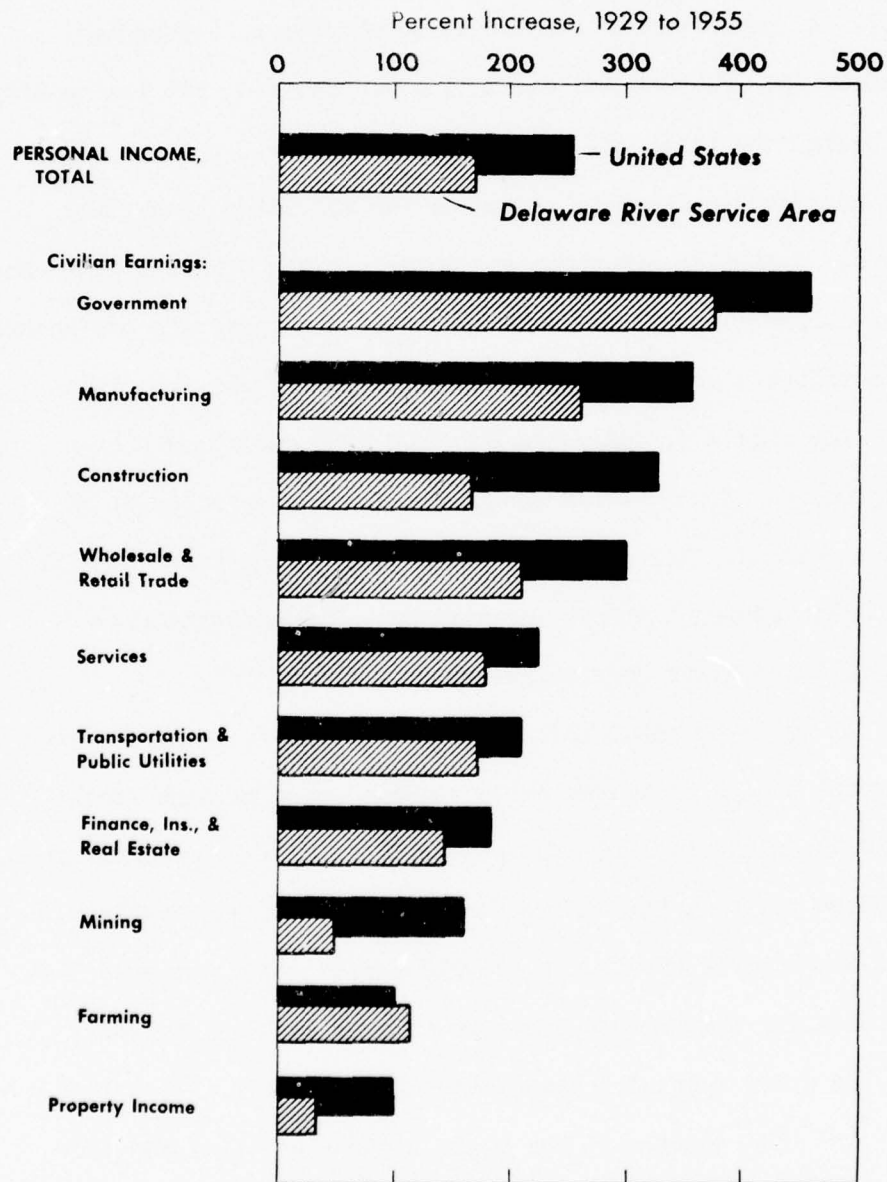
Although the county is the basic unit used, estimates of personal income are not presented here in that detail for two reasons. First, for a number of components the most satisfactory data on which to base an estimate were available for metropolitan areas or for groups of counties. Secondly, income estimates for individual counties are not shown because of the lack of requisite data for making adjustments to take account of commuting of workers. Some income components (wages and salaries, in particular) are measured at the point of disbursement (place of work), while others (property income, for example) are estimated on a residence basis. Where workers reside in one county and work in another, personal income is estimated partly on a "where-received" basis and partly on a "where earned" concept. Data suitable to convert personal income wholly to either of the two definitions are lacking. This problem is "solved" by reason of the fact that commuting across area lines is at a minimum in the geographic subareas delineated. The



Figure 6

## Economic Trends in United States and Delaware River Service Area

### Growth of Personal Income and Its Components



U. S. Department of Commerce, Office of Business Economics

Data: See Table 15

publishing of meaningful estimates by counties is precluded, however, by this procedure.

(2) The income estimates for the sub-regions of the Delaware Area cover the years 1929, 1940, 1950, 1955, and 1957. A longer period over which to observe relationships between the subareas and the Nation was desired, but the quality of basic data falls off so sharply back of 1929 that we did not consider it feasible to extend the estimates to earlier years. A similar situation characterizes the official State income series, even though data for estimating purposes are generally more reliable and plentiful on a State than local-area basis.

Nevertheless, the years 1929 and 1957 encompass a span long enough to permit the identification and measurement of secular trend. Moreover, the three intervening years provide valuable reference points for verifying the economic growth of the Delaware River Service Area within the period.

It is to be noted that the years for which we constructed personal income estimates are peacetime years of high level activity, although 1940 must be qualified in this regard. Thus, in these years we have an optimum selection of observations. Most other years within the overall period would not have been suitable for trend measurement because of cyclical factors, war, or other special considerations.

(3) In addition to the basic figures on total and per capita income, the estimates are prepared in sufficient detail to show income by type and by major industrial source.

This detail is shown in Tables 23 through 32 for the Nation, the Delaware River Service Area, and each of its 8 sub-regions.

There are two parts to each table. The upper section contains a breakdown of personal income by type of income -- wages and salaries, proprietors' income, property income, etc. The lower portion presents an industrial distribution of a large segment of total income -- approximately 80 percent. This segment -- termed civilian earnings -- includes the combined total of wages and salaries, other labor income, and net income of proprietors in each industry. Civilian earnings exclude property income, transfer payments, personal contributions for social insurance (a deduction), and military payrolls. The first three items are excluded because no industrial breakdown of them is available. Military pay is excluded on technical grounds. Despite the "partial" nature of the civilian earnings measure, it qualifies as an excellent indicator of the industrial composition of an area's economy.

These industrial and type-of-income data constitute fundamental information on the structure of the economy of each sub-region, both currently and historically. They provide a basis for understanding past trends in income and for projecting them into the future.

(4) The special, local-area income estimates prepared for this economic survey conform directly to State personal income, a major aggregate in OBE's national income and product accounts.

Both statistically and conceptually, the State series and Delaware Area estimates are in complete agreement. In fact, the State totals of the various income components provided the statistical framework used in preparing detailed breakdowns of personal income by subareas.

In essence, our procedure was to subdivide the State total of each of about 100 components of personal income in Connecticut, Delaware, New Jersey, New York, and Pennsylvania into estimates of the amount received by residents of local areas (counties). The component estimates were summed for each area. These totals were recombined into the eight economically meaningful sub-regions, of the Delaware River Service Area.

The income estimates were constructed in the careful detailed procedure outlined in Chapter V. The description of methods given there serves not only to furnish a record of procedure but to provide information useful to research workers, administrators, and others who use our personal income figures.

#### ESTIMATES AND PROJECTIONS -- A SUMMARY

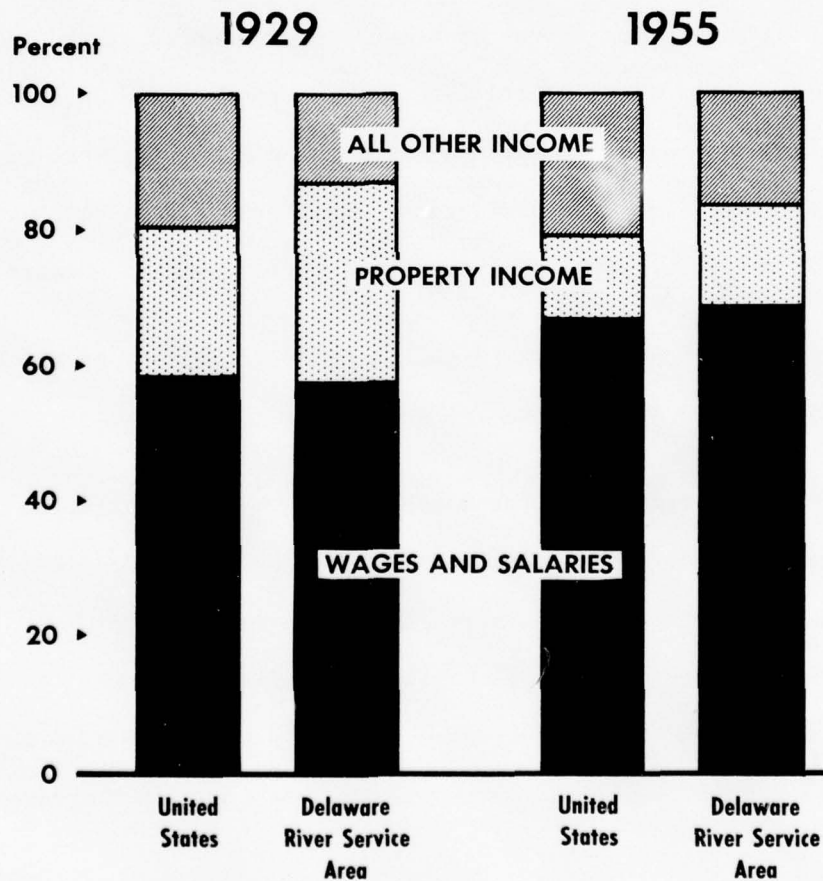
Based largely on the personal income figures described above, supplemented by related estimates of population and employment, the economy of the Delaware River Service Area as a whole and of its 8 sub-regions was projected to 1965, 1980, and 2010. These



Figure 7

## Sources of Personal Income

Comparative Distribution for United States  
and Delaware River Service Area



U. S. Department of Commerce, Office of Business Economics

Data: See Tables 17 & 18

projections are expressed in terms of 4 key measures -- total personal income, per capita personal income, employment, and population.

Tables 7 through 14 constitute the statistical heart of this economy survey. They show our full set of summary measures -- historically and projected -- for the United States, the Delaware River Service Area, and each sub-region. The tables are arranged in pairs, with each pair relating to one of the 4 basic measures listed below. In every case, the first of the two tables presents back-year data and the second sets forth the projections. The historical tables relating to income cover the 5 specified years from 1929 to 1957. For employment and population, the historical series extends through 1955.

Following are the summary highlights of the economy of the Delaware River Service Area -- present and future.

In 1955, the last year for which employment and population figures are available on an area basis, the 21-1/2 million residents of the Delaware River Service area provided a labor force of 9 million people and received \$51 billion of personal income. By 1957, aggregate income had increased to nearly \$58 billion -- an advance of almost \$7 billion in two years. On a per capita basis

TABLE 7

DELAWARE RIVER SERVICE AREA  
PERSONAL INCOME ESTIMATES BY SUB-REGIONS, 1929-57

(Millions of dollars)

	1929	1940	1950	1955	1957
UNITED STATES.....	85,661	78,522	225,473	306,598	347,911
Delaware River Service Area...	18,620	15,762	38,373	51,107	57,632
New York City Metropolitan..	13,324	11,130	26,465	34,915	39,280
New York City Supplement....	742	695	1,769	2,549	2,902
Bethlehem-Allentown-Reading.	494	467	1,215	1,542	1,764
Trenton Metropolitan.....	143	145	436	577	657
Philadelphia Metropolitan...	3,161	2,580	6,612	8,995	10,095
Wilmington Metropolitan.....	228	258	633	960	1,114
Upper Basin.....	314	282	662	777	902
Southern Basin and Coastal..	213	205	582	792	918

TABLE 8

DELAWARE RIVER SERVICE AREA  
PERSONAL INCOME PROJECTIONS BY SUB REGIONS IN CONSTANT DOLLARS, 1965-2010

(Billions of 1957 dollars)

	1965	1980	2010
UNITED STATES.....	450.0	725.0	1,800.0
Delaware River Service Area...	70.0	100.0	224.0
New York City Metropolitan..	46.7	64.4	139.0
New York City Supplement....	3.8	6.2	17.0
Bethlehem-Allentown-Reading.	2.2	3.3	7.8
Trenton Metropolitan.....	.9	1.4	4.0
Philadelphia Metropolitan...	12.1	17.8	39.5
Wilmington Metropolitan.....	1.6	2.6	7.0
Upper Basin.....	1.2	1.8	4.0
Southern Basin and Coastal..	1.3	2.3	6.1

TABLE 9

## DELAWARE RIVER SERVICE AREA

PER CAPITA PERSONAL INCOME ESTIMATES BY SUB-REGIONS, 1929-57  
(Dollars)

	1929	1940	1950	1955	1957
UNITED STATES.....	703	595	1,491	1,866	2,043
Delaware River Service Area...	1,138	890	1,929	2,367	2,600
New York City Metropolitan..	1,262	955	2,041	2,521	2,800
New York City Supplement....	963	811	1,693	2,088	2,350
Bethlehem-Allentown-Reading.	796	692	1,646	1,932	2,150
Trenton Metropolitan.....	776	730	1,890	2,308	2,575
Philadelphia Metropolitan...	1,001	806	1,796	2,183	2,400
Wilmington Metropolitan.....	1,165	1,156	2,340	2,917	3,200
Upper Basin.....	576	511	1,221	1,410	1,575
Southern Basin and Coastal..	643	581	1,399	1,690	1,875

TABLE 10

## DELAWARE RIVER SERVICE AREA

PER CAPITA PERSONAL INCOME PROJECTIONS BY SUB REGIONS IN CONSTANT DOLLARS,  
1965-2010

(In 1957 dollars)

	1965	1980	2010
UNITED STATES.....	2,300	2,900	4,900
Delaware River Service Area...	2,800	3,300	5,300
New York City Metropolitan..	2,900	3,500	5,500
New York City Supplement....	2,500	3,100	5,000
Bethlehem-Allentown-Reading.	2,400	3,000	5,000
Trenton Metropolitan.....	2,800	3,600	6,100
Philadelphia Metropolitan...	2,500	3,100	5,000
Wilmington Metropolitan.....	3,500	4,300	7,000
Upper Basin.....	1,800	2,300	4,200
Southern Basin and Coastal..	2,100	2,700	4,700



Table 11

DELAWARE RIVER SERVICE AREA  
POPULATION BY SUB-REGIONS, 1930-1955  
(Thousands)

	1930	1940	1950	1955
CONTINENTAL UNITED STATES...	122,775	131,669	150,697	164,303
Delaware River Service Area.....	16,705	17,715	19,811	21,589
New York City Metropolitan.....	10,859	11,661	12,912	13,851
New York City Supplement.....	783	857	1,039	1,221
Bethlehem-Allentown-Reading....	658	675	736	798
Trenton Metropolitan.....	187	197	230	250
Philadelphia Metropolitan.....	3,137	3,200	3,671	4,121
Wilmington Metropolitan.....	198	222	268	329
Upper Basin.....	547	553	541	551
Southern Basin and Coastal.....	335	351	414	469

Table 12

DELAWARE RIVER SERVICE AREA  
POPULATION PROJECTIONS BY SUB-REGIONS, 1965-2010  
(Thousands)

	1965	1980	2010
UNITED STATES.....	195,000	248,000	370,000
Delaware River Service Area.....	25,000	30,000	42,000
New York City Metropolitan.....	16,000	18,500	25,000
New York City Supplement.....	1,500	2,000	3,400
Bethlehem-Allentown-Reading....	900	1,100	1,550
Trenton Metropolitan.....	300	400	650
Philadelphia Metropolitan.....	4,800	5,800	7,900
Wilmington Metropolitan.....	450	600	1,000
Upper Basin.....	650	750	950
Southern Basin and Coastal.....	600	850	1,300

Table 13

DELAWARE RIVER SERVICE AREA  
EMPLOYMENT BY SUB-REGIONS, 1930-1955

	1930	1940	1950	1955
CONTINENTAL UNITED STATES.....	48,833	45,166	57,222	65,250
Delaware River Service Area.....	7,309	6,613	8,102	9,073
New York City Metropolitan.....	4,859	4,421	5,338	5,897
New York City Supplement.....	318	322	418	495
Bethlehem-Allentown-Reading.....	264	254	312	357
Trenton Metropolitan.....	77	76	98	110
Philadelphia Metropolitan.....	1,365	1,165	1,467	1,671
Wilmington Metropolitan.....	84	86	106	136
Upper Basin.....	202	165	201	214
Southern Basin and Coastal.....	140	123	161	193

Table 14

DELAWARE RIVER SERVICE AREA  
EMPLOYMENT PROJECTIONS BY SUB-REGIONS, 1965-2010

	1965	1980	2010
UNITED STATES.....	76,000	97,000	151,000
Delaware River Service Area.....	10,300	12,400	18,000
New York City Metropolitan.....	6,600	7,800	11,000
New York City Supplement.....	600	800	1,400
Bethlehem-Allentown-Reading.....	400	470	700
Trenton Metropolitan.....	130	170	280
Philadelphia Metropolitan.....	1,910	2,300	3,300
Wilmington Metropolitan.....	180	240	420
Upper Basin.....	240	280	380
Southern Basin and Coastal.....	240	340	540

this amounted to \$2,600 -- a figure one-fourth higher than that for the Nation as a whole.

By 2010, it is anticipated that the population and labor force of the Area will have nearly doubled; the flow of personal income will have quadrupled; and average incomes in real terms will be twice their present level. These expanded economic dimensions are portrayed graphically in Figure 5.

Expansion in income, population, and employment is envisaged throughout the Delaware Area. In general, the sub-regions for which the biggest gains in total income are projected are also those in which the greatest population growth is anticipated. Accordingly, relative increases in real per capita incomes show considerable uniformity.

#### Basis of Projections

Two aspects of the expansion set forth in the projections merit special attention. Both are important in their own right, in that they provide analytically useful information regarding the economic future of the Area; and, in addition, study of them is essential in order to assess the validity of our approach.

The first of these is that the projected large growth of the Delaware Area is percentage-wise somewhat less than that assumed for the country as a whole.

This relationship between Area and national growth is derived from study of the past economic record as measured in the statistics presented in this report, particularly those in Tables 15-16 (See Figures 9 and 10, also). From 1929 to 1957 total personal income in the Delaware River Service Area (measured in current dollars) increased two-fold; nationally, it expanded three-fold. The growth of the Area in some aspects was higher in the initial quarter of the 20th century than in the 1929-57 period. This is discussed in a later chapter dealing with population.

In all 5 types of income (wages and salaries, proprietors' income, etc.) and in earnings in all major industries except one, the regional rate of gain since 1929 has been less than that for the Nation (See Figure 6). Farming, the one industry in which the Area's growth matched that of the Nation from 1929 to 1957, accounts for less than one percent of its total income.

It was pointed out early in this chapter that the economic projections derived here are based essentially on an extension of past differentials in rates of growth between the region and the Nation. In the case of the Area projection, there appear to be factors that warrant substantial modification of these relationships. This is of such importance as to qualify as the second of the two features of the projections that were referred to as meriting particular attention.

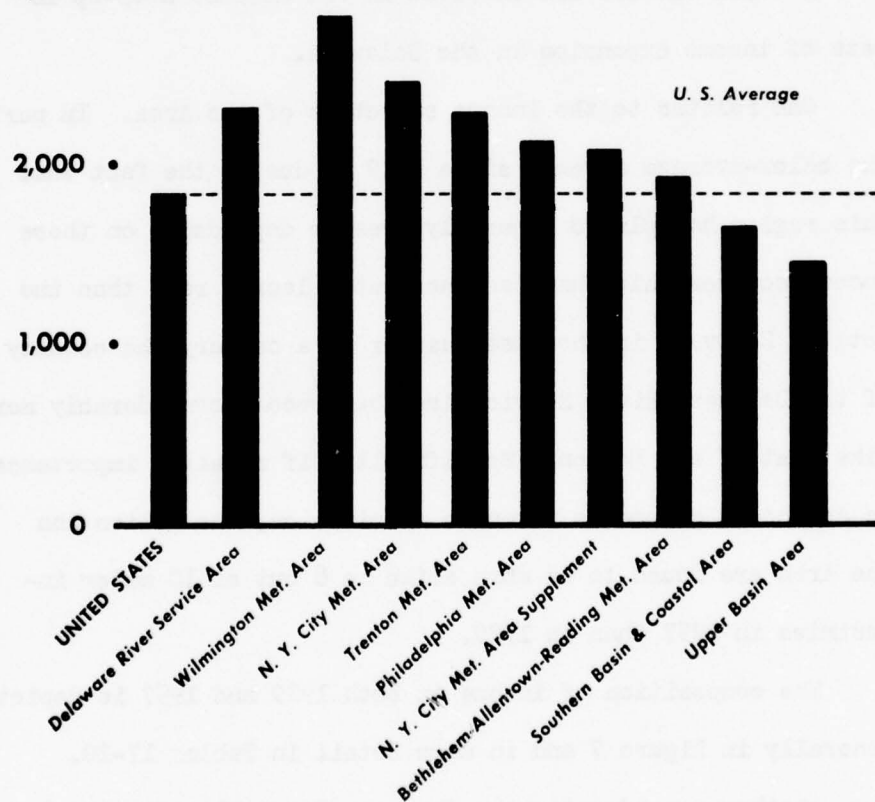


Figure 8

## Delaware River Service Area

Personal Income Per Capita  
Compared With U. S. Average, 1955

Dollars  
3,000 •



U. S. Department of Commerce, Office of Business Economics

Data: See Table 9

Under the assumptions which attach to this study, we are projecting a rate of income growth for the Delaware River Service Area that is higher than that of the past 28 years. From 1929 to 1957, total income in the Area expanded at an average annual rate of slightly more than 2 percent; the rate embodied in the projections for the next half century is somewhat over  $2\frac{1}{2}$  percent.

Several factors are involved in the assumed step-up in rate of income expansion in the Delaware.

One relates to the income structure of the Area. In part, the below-average advance since 1929 is due to the fact that this region has placed generally greater dependence on those income sources which have advanced at a lesser rate than the total. However, in the past quarter of a century the economy of the Delaware River Service Area has become considerably more like that of the Nation. Specifically, if relative importance as an income source is taken as a criterion, the Nation and the Area are found to be more alike in 8 out of 10 major industries in 1957 than in 1929.

The composition of income in both 1929 and 1957 is depicted generally in Figure 7 and in more detail in Tables 17-20.

Another consideration in the more favorable relative income growth anticipated for the Delaware Area in the future stems from the fact that this Area had achieved a large measure of economic maturity by 1929. That is, its decline in relative

TABLE 15  
INCOME CHANGES IN THE DELAWARE RIVER SERVICE AREA  
BY INDUSTRY AND BY MAJOR TYPE

PERCENT INCREASE, 1929-1957

	UNITED STATES	Delaware River Service Area	New York City Metropolitan	New York City Supplement	Bethlehem -Al- lentown-Reading	Trenton Metropolitan	Philadelphia Metropolitan	Wilmington Metropolitan	Upper Basin	Southern Basin and Coastal
TOTAL INCOME	306	210	195	291	257	359	219	389	187	331
CIVILIAN EARNINGS										
All Industries	331	262	248	390	273	416	273	476	200	340
Farms	100	103	145	110	106	100	79	50	73	133
Mining	206	75	318	200	0	21	50	21	16	300
Construction	417	199	148	620	320	175	294	518	462	455
Manufacturing	418	309	279	478	313	541	325	593	414	657
Trade	344	244	241	328	242	368	219	458	252	388
Finance	255	188	180	361	310	533	185	333	250	460
Transportation, Communication, and Utilities	251	211	211	226	181	414	204	308	140	307
Services	293	228	223	326	268	393	219	365	194	161
Government	553	520	534	505	295	462	608	700	180	381
PROPERTY INCOME	133	55	48	81	144	125	49	214	62	133
TRANSFER PAY- MENT	1348	1134	1058	1427	1275	1850	1279	1267	1014	1825

Table 16

## CHANGES IN TOTAL PERSONAL INCOME IN THE DELAWARE RIVER

## SERVICE AREA, SELECTED YEARS, 1929-57

	Percent of United States				
	1929	1940	1950	1955	1957
UNITED STATES.....	100.00	100.00	100.00	100.00	100.00
Delaware River Service Area.....	21.74	20.07	17.02	16.67	16.57
New York City Metropolitan....	15.54	14.17	11.75	11.39	11.29
New York City Supplement.....	.87	.89	.78	.83	.83
Bethlehem-Allentown-Reading...	.58	.59	.54	.50	.51
Trenton Metropolitan.....	.17	.18	.19	.19	.19
Philadelphia Metropolitan.....	3.69	3.29	2.93	2.93	2.90
Wilmington Metropolitan.....	.27	.33	.28	.31	.32
Upper Basin.....	.37	.36	.29	.25	.26
Southern Basin and Coastal....	.25	.26	.26	.26	.26

	Percent increase		
	1929 to 1957	1940 to 1957	1950 to 1957
UNITED STATES.....	306	343	54
Delaware River Service Area.....	210	266	50
New York City Metropolitan....	195	253	48
New York City Supplement.....	291	318	64
Bethlehem-Allentown-Reading...	257	278	45
Trenton Metropolitan.....	359	353	51
Philadelphia Metropolitan.....	219	291	53
Wilmington Metropolitan.....	389	332	76
Upper Basin.....	187	220	36
Southern Basin and Coastal....	331	348	58



income position since then reflects to some extent the industrial, commercial, and population growth of the newer and less developed parts of the country. As these sections progress and become economically more mature, their rate of expansion relative to that of the Nation will tend to taper, and this particular source of regional growth differentials will become less important.

Finally, we deliberately chose to adopt a conservative approach. As the term of an economic projection is lengthened, the degree of uncertainty is greater, particularly as the geographic area concerned becomes smaller.

Accordingly, we have projected the relative growth of individual industries or economic aggregates in the Delaware Area and each sub-region up to 1980 in consonance with measured historical trends, modified by such future developments as can be anticipated with reasonable confidence. Beginning at 1980 (though no precision attaches to the specific year), the projected trend is moved upward toward the national rate of growth.

The major factors underlying the step-up in rate of economic growth projected for the Delaware Service Area have been noted. Those relating to comparative rates of expansion in the various regions of the Nation and to the shaping of the Area's income trend towards the national average after 1980 need no further explanation. The influence of shifts in income composition, however, may be amplified by special consideration of two major sources of income.

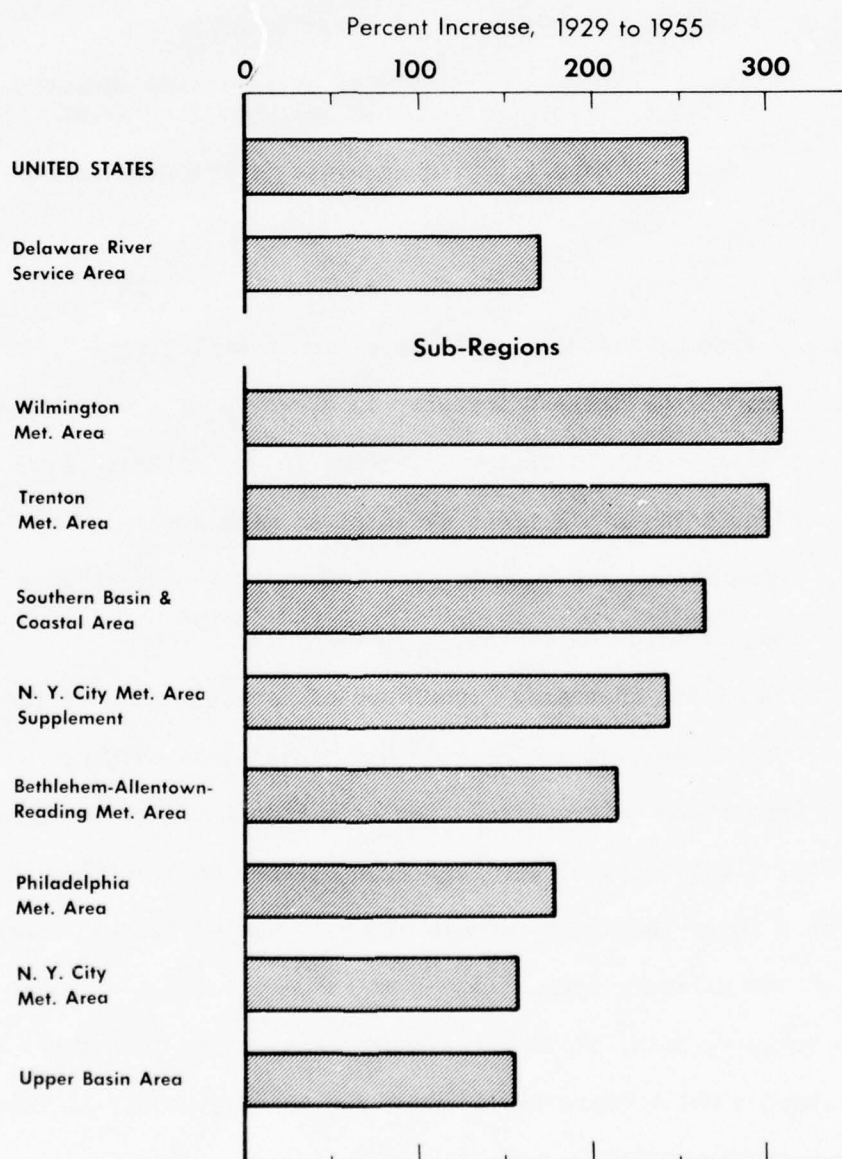
Property income.--One of the most striking and significant changes in the economy of the Delaware River Service Area since 1929 has been the sharp reduction in the importance of capital investments as a source of income.

In 1929, rents, dividends, and interest accounted for 30 percent of all personal income in the Area, a figure half again as large as the comparable proportion for the Nation. From 1929 to 1957, income from investments in the country as a whole more than doubled, while the flow of other income quadrupled. Moreover, in the Delaware Area itself property income expanded only one-half. Accordingly, this income flow now accounts for 15 percent of personal income in the region, a fraction not much higher than that for the country as a whole.

It is clear, then, that property income has been a major factor in the Delaware Area's less-than-average income growth since 1929. The extent of its direct influence is indicated by the fact that the Area's percentage share of the Nation's total income declined one-fourth from 1929 to 1957. If property income is excluded from the comparison, the reduction is only one-sixth. With the lessened importance of property in the Area's income structure, we can anticipate that this source will not exercise the dampening influence on the Area's overall income record in the future that it has in the past.

Figure 9

## Long-Term Growth in Personal Income Delaware River Service Area and Sub-Regions



U. S. Department of Commerce, Office of Business Economics

Data: See Table 16

Manufacturing.--Aggregate earnings of persons engaged in manufacturing have replaced property income as the largest element in the personal income flow in the Delaware Area. As shown by the following figures, the roles of property income and manufacturing in 1957 were the reverse of those in 1929.

Percent of total income received in the Delaware Area from:		
	Manufacturing earnings	Property income
1929	20	30
1957	26	15

As a source of income as well as a direct employer of labor, manufacturing is the largest industry in the Area by a wide margin. Over the span since 1929, factory earnings in the Delaware Area have increased more than 3 times as compared with a rise of  $1\frac{1}{2}$  times in nonmanufacturing income. The industry has thus been a strongly buoyant force on overall income growth.

Because of the increased importance of manufacturing in the Area's income structure, and because our projections envisage a somewhat larger-than-average gain for this industry over the next half century, individuals' earnings from factory employment will likely be a force tending to accelerate the pace of future economic growth in the Delaware Area.

In summary, then, it is a reasonable assumption that these two income sources which currently account for two-fifths of all personal income in the Area will operate in the future to reduce the gap that has existed between the rate of income growth in the Delaware Area and in the Nation.



SOURCES OF PERSONAL INCOME IN THE DELAWARE RIVER SERVICE AREA:

Table 17

PERCENT DISTRIBUTION BY TYPE OF INCOME, 1929

	Total income	Wages and salaries		Other labor income
		Total	Private	Government
UNITED STATES.....	100.0	58.7	53.1	5.6
Delaware River Service Area.....	100.0	57.5	53.5	4.0
New York City Metropolitan.....	100.0	57.2	53.5	3.7
New York City Supplement.....	100.0	52.0	45.3	6.7
Bethlehem-Allentown-Reading.....	100.0	65.3	61.2	4.1
Trenton Metropolitan.....	100.0	63.2	54.0	9.2
Philadelphia Metropolitan.....	100.0	58.4	54.6	3.8
Wilmington Metropolitan.....	100.0	53.4	50.3	3.1
Upper Basin.....	100.0	61.7	53.7	8.0
Southern Basin and Coastal.....	100.0	60.7	52.3	8.4

	Proprietors' income		Property income	Transfer payments	Less: Personal contributions for social insurance
	Total	Farm Nonfarm			
UNITED STATES.....	17.2	7.0	10.3	21.8	1.7
Delaware River Service Area.....	10.8	.5	10.2	29.8	1.4
New York City Metropolitan.....	10.9	.1	10.8	30.1	1.4
New York City Supplement.....	10.9	1.5	9.5	35.3	1.5
Bethlehem-Allentown-Reading.....	11.3	2.5	8.8	21.2	1.6
Trenton Metropolitan.....	9.9	.4	9.5	24.8	1.6
Philadelphia Metropolitan.....	9.6	.7	8.9	30.2	1.3
Wilmington Metropolitan.....	7.6	1.2	6.4	37.5	1.1
Upper Basin.....	15.5	6.2	9.2	20.2	2.2
Southern Basin and Coastal.....	15.9	7.0	8.9	21.0	2.0

Table 18

## SOURCES OF PERSONAL INCOME IN THE DELAWARE RIVER SERVICE AREA:

## PERCENT DISTRIBUTION BY TYPE OF INCOME, 1957

	: Total : : income :	Wages and salaries		: Total : : income :	: Property : : income :	Transfer: Less: Personal		: Other labor : : income :
		Private	Government			payments:	contributions for : social insurance	
UNITED STATES.....	100.0	67.8	57.0	10.8	2.6			
Delaware River Service Area.....	100.0	69.4	60.8	8.6	2.7			
New York City Metropolitan.....	100.0	69.8	61.6	8.2	2.6			
New York City Supplement.....	100.0	66.3	56.1	10.2	2.4			
Bethlehem-Allentown-Reading.....	100.0	68.9	64.1	4.8	3.5			
Trenton Metropolitan.....	100.0	71.8	60.5	11.3	3.0			
Philadelphia Metropolitan.....	100.0	70.4	60.3	10.1	2.9			
Wilmington Metropolitan.....	100.0	64.2	58.8	5.4	3.5			
Upper Basin.....	100.0	63.6	55.5	8.1	3.0			
Southern Basin and Coastal.....	100.0	63.8	51.2	12.6	2.5			
: Proprietors' income : Property : Transfer: Less: Personal								
: Total Farm Nonfarm : income : payments: contributions for								
: : : : : : : : : : social insurance								
UNITED STATES.....	12.8	3.4	9.4	12.5	6.2	1.9		
Delaware River Service Area.....	9.2	.4	8.9	15.0	5.6	1.9		
New York City Metropolitan.....	9.1	.1	9.0	15.1	5.5	2.0		
New York City Supplement.....	11.1	1.0	10.1	16.4	5.8	1.9		
Bethlehem-Allentown-Reading.....	8.7	1.2	7.4	14.5	6.2	1.8		
Trenton Metropolitan.....	8.7	.3	8.4	12.3	5.9	1.8		
Philadelphia Metropolitan.....	8.7	.4	8.3	14.0	5.7	1.7		
Wilmington Metropolitan.....	5.7	.3	5.5	24.2	3.7	1.3		
Upper Basin.....	15.3	3.8	11.5	11.5	8.6	2.1		
Southern Basin and Coastal.....	15.6	3.6	12.0	11.4	8.4	1.7		

SOURCES OF CIVILIAN EARNINGS IN THE DELAWARE RIVER SERVICE AREA:  
PERCENT DISTRIBUTION BY INDUSTRY, 1929

Table 19

	All Industries	Farms	Mining	Construction	Manufacturing	Trade
UNITED STATES.....	100.0	11.1	2.4	5.6	25.7	18.9
Delaware River Service Area.....	100.0	1.2	.5	6.9	28.7	22.0
New York City Metropolitan.....	100.0	.3	.1	7.2	27.2	22.8
New York City Supplement.....	100.0	4.5	.2	5.4	32.3	18.4
Bethlehem-Allentown-Reading.....	100.0	4.5	.9	5.1	46.8	16.2
Trenton Metropolitan.....	100.0	1.5	.2	11.3	32.5	17.8
Philadelphia Metropolitan.....	100.0	1.8	.4	6.0	32.5	22.2
Wilmington Metropolitan.....	100.0	4.6	.1	7.6	43.0	13.8
Upper Basin.....	100.0	10.6	18.6	3.4	17.8	12.8
Southern Basin and Coastal.....	100.0	13.1	.5	6.6	13.9	19.5

	Finance	Transportation, communication, and utilities	Service	Government	Other
UNITED STATES.....	5.7	10.1	13.0	7.0	0.3
Delaware River Service Area.....	8.4	10.0	16.5	5.6	.1
New York City Metropolitan.....	9.7	10.0	17.3	5.2	.0
New York City Supplement.....	3.9	9.5	16.8	8.7	.4
Bethlehem-Allentown-Reading.....	2.7	9.4	9.0	5.4	.1
Trenton Metropolitan.....	3.3	6.8	14.1	12.5	.1
Philadelphia Metropolitan.....	6.6	10.5	14.7	5.4	.1
Wilmington Metropolitan.....	4.5	9.3	12.2	4.7	.2
Upper Basin.....	2.3	10.4	13.5	10.3	.3
Southern Basin and Coastal.....	3.4	8.7	22.3	9.9	2.1

## Table 20

### PERCENT DISTRIBUTION BY INDUSTRY, 1957

	All	Industries:	Farms:	Mining:	Construction:	Manufacturing:	Trade
UNITED STATES.....	100.0	5.2	1.7	6.7	30.9	19.5	
Delaware River Service Area.....	100.0	.7	.3	5.7	32.4	20.9	
New York City Metropolitan.....	100.0	.2	.1	5.2	29.6	22.4	
New York City Supplement.....	100.0	2.0	.1	8.0	38.2	16.1	
Bethlehem-Allentown-Reading.....	100.0	2.5	.3	5.9	51.9	14.9	
Trenton Metropolitan.....	100.0	.7	1/	6.0	39.9	16.3	
Philadelphia Metropolitan.....	100.0	.8	1	6.4	37.0	19.0	
Wilmington Metropolitan.....	100.0	1.1	1/	8.4	51.6	13.2	
Upper Basin.....	100.0	6.2	7.1	6.2	30.9	14.9	
Southern Basin and Coastal.....	100.0	6.9	.6	8.6	24.4	21.9	

	Finance	Transportation, communication, and utilities	Service	Government	Other
UNITED STATES.....	4.7	8.2	11.9	10.7	0.3
Delaware River Service Area.....	6.7	8.6	14.9	9.6	.2
New York City Metropolitan.....	7.8	9.0	16.1	9.5	.1
New York City Supplement.....	3.7	6.2	14.5	10.7	.4
Bethlehem-Allentown-Reading.....	2.9	7.1	8.8	5.5	.3
Trenton Metropolitan.....	3.5	6.6	13.5	13.3	.2
Philadelphia Metropolitan.....	5.1	8.6	12.6	10.2	.2
Wilmington Metropolitan.....	3.2	6.6	9.8	6.0	.1
Upper Basin.....	2.9	8.2	13.3	9.6	.8
Southern Basin and Coastal.....	3.9	8.0	13.2	10.8	1.7

1/ Less than 0.05 per cent.



### Economy of Sub-Regions

The foregoing discussion has centered on the Delaware River Area as a whole. But, as indicated in the tables, all historical estimates and projections were also made for each sub-region. The following sections present highlights that are discernible on a sub-regional basis but which usually are masked when the Area is examined.

There is wide disparity in the economic size and characteristics of the individual sub-regions of the Delaware Area. This is summarized in Table 21.

The New York City Metropolitan Area accounts for 68 percent of total personal income in the Delaware region; 18 percent goes to residents of the Philadelphia Area; and only 14 percent is received by the combined population of the other 6 regions.

These 6 smaller sub-regions of the Delaware Area receive about 2½ percent of all personal income in the Nation. Although they are dwarfed in size by the New York and Philadelphia Metropolitan Areas, the comparison is relative only.

Another important facet of the economic profile of these sub-regions is the size of their prevailing per capita incomes. Generally, the Delaware River Service Area is characterized by

comparatively high average incomes. In 1957, the Area's per capita income of about \$2,600 was more than one-fourth higher than the national figure. In 6 of the 8 sub-regions also, income is higher than in most other sections of the country. Particularly striking are the averages for the sub-regions centering on Wilmington and New York City. In them, per capita income exceeds the national average by nearly three-fifths and two-fifths, respectively. (See Table 22 and Figure 8.)

In contrast are the income levels of the less populous Upper Basin Area and Southern Basin and Coastal Area. Here, incomes fall short of the national average by one-fifth and one-tenth, respectively.

The economic structures of most of the sub-regions are comparatively uniform, and generally similar to that of the Service Area as a whole. In only two are there substantial differences in income composition. The Upper Basin Area and the Southern Basin and Coastal Area have several common features which serve to differentiate them from the other 6 sub-regions.

These two areas are moderately agricultural. As shown in tables 19 and 20, they derive a larger percentage of labor earnings from farming than any of the other sub-regions, or the country as a whole. This is the main reason for the substantial importance of proprietors' earnings as a source of income in these sub-regions. Conversely, it explains the less-than-average importance of wages and salaries.

Table 21

## ECONOMIC DIMENSIONS OF THE DELAWARE RIVER SERVICE AREA, 1957

	Personal income		: Per capita income	
	Amount (millions)	Percent of U. S.:	Amount (dollars)	Percent of national average
UNITED STATES.....	347,911	100.00	2,027	100
Delaware River Service Area...	57,632	16.57	2,600	128
New York City Metropolitan..	39,280	11.29	2,800	138
New York City Supplement....	2,902	.83	2,350	116
Bethlehem-Allentown-Reading.	1,764	.51	2,150	106
Trenton Metropolitan.....	657	.19	2,575	127
Philadelphia Metropolitan...	10,095	2.90	2,400	118
Wilmington Metropolitan.....	1,114	.32	3,200	158
Upper Basin.....	902	.26	1,575	78
Southern Basin and Coastal..	918	.26	1,875	93

Table 22

## CHANGES IN PER CAPITA PERSONAL INCOME IN THE DELAWARE RIVER

## SERVICE AREA, SELECTED YEARS, 1929-57

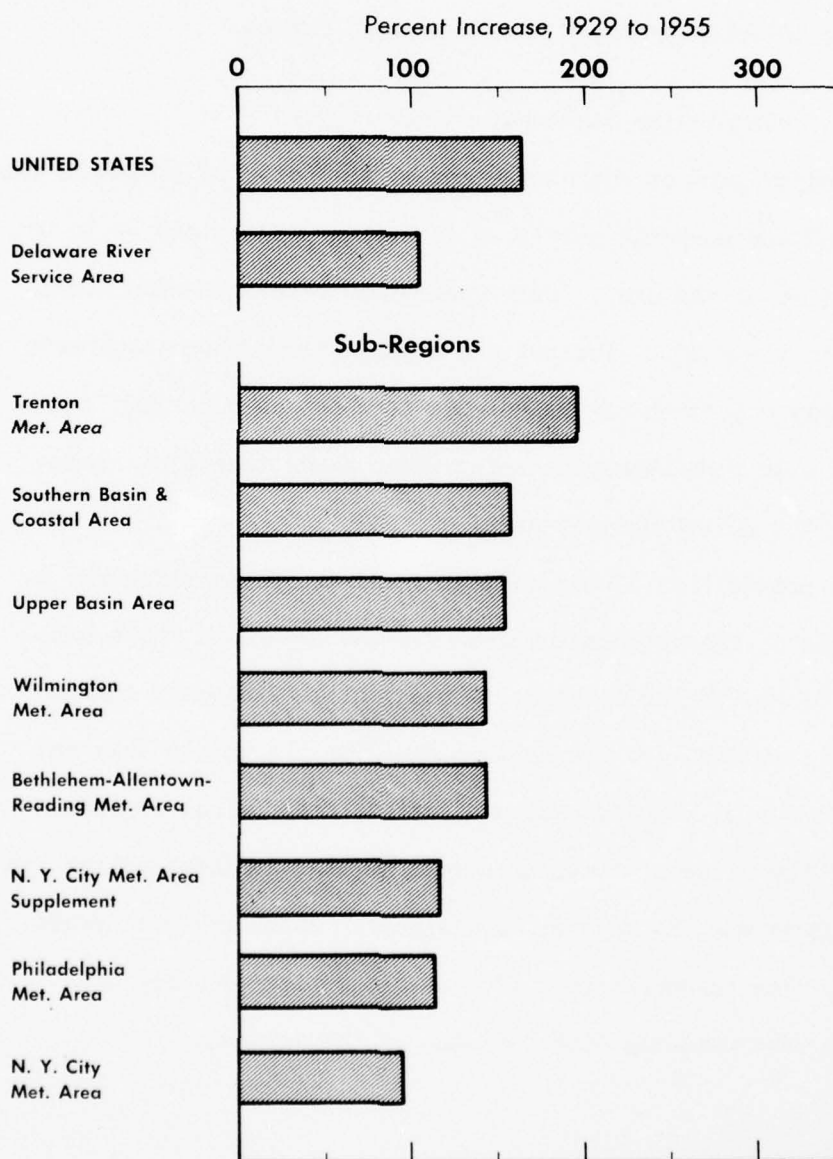
	Percent of national average				
	1929	1940	1950	1955	1957
UNITED STATES.....	100	100	100	100	100
Delaware River Service Area....	162	150	129	127	128
New York City Metropolitan...	180	161	137	135	138
New York City Supplement.....	137	136	114	112	116
Bethlehem-Allentown-Reading..	113	116	110	104	106
Trenton Metropolitan.....	110	123	127	124	127
Philadelphia Metropolitan....	142	135	120	117	118
Wilmington Metropolitan.....	166	194	157	156	158
Upper Basin.....	82	86	82	76	78
Southern Basin and Coastal...	91	98	94	91	93

	Percent increase		
	1929 to 1957	1940 to 1957	1950 to 1957
UNITED STATES.....	191	243	37
Delaware River Service Area....	128	192	35
New York City Metropolitan...	122	193	37
New York City Supplement.....	144	190	39
Bethlehem-Allentown-Reading..	170	211	31
Trenton Metropolitan.....	232	253	36
Philadelphia Metropolitan....	140	198	34
Wilmington Metropolitan.....	175	177	37
Upper Basin.....	173	208	29
Southern Basin and Coastal...	192	223	34



Figure 10

## Long-Term Growth in Per Capita Personal Income Delaware River Service Area and Sub-Regions



U. S. Department of Commerce, Office of Business Economics

Data: See Table 22

Other factors differentiating these two sub-regions from the Delaware Area as a whole include the smaller emphasis on manufacturing and the larger role of government; the importance of mining in the Upper Basin -- a major industry even now, though only about one-third as large as in 1929; and the lesser importance of invested property as a source of income.

#### Concluding Statement on Sub-regions

A major part of the assignment by the Corps of Engineers was to extend the economic survey -- including projections -- to the sub-regions of the Area. Such geographic extension adds flexibility to the study. Persons and organizations whose interests cover only a portion of the Service Area are able to find a geographic area more nearly matching their needs than that encompassing the entire Service Area.

In preparation of the estimates and projections for the 8 sub-regions, the methods outlined for the Area as a whole were used. Of particular interest is the fact that closely similar figures resulted from projections made for the entire Area and from the sum of the separate projections for the sub-regions. Despite the close statistical agreement, the projections for the sub-regions must be accorded a distinctly lower order of probability. The reasonableness of each projection probably will tend to vary directly with the size of the subarea.

Table 23

UNITED STATES  
PERSONAL INCOME BY TYPE, SELECTED YEARS 1929-1957  
(Millions of dollars)

	1929	1940	1950	1955	1957
PERSONAL INCOME.....	85,661	78,522	225,473	306,598	347,911
By Type					
Wages and salaries.....	50,319	49,656	145,092	208,039	235,866
Other labor income.....	561	687	3,823	7,136	9,144
Proprietors' income.....	14,759	13,010	36,140	41,421	44,483
Farm.....	5,968	4,568	13,285	11,767	11,780
Nonfarm.....	8,791	8,442	22,855	29,654	32,703
Property income.....	18,666	12,709	28,308	37,690	43,441
Transfer payments	1,496	3,114	14,969	17,471	21,668
Less: Personal contributions for social insurance..	139	656	2,858	5,155	6,689
CIVILIAN EARNINGS: 1/.....	65,380	62,851	180,945	248,663	281,491
By Industry					
Farms.....	7,259	5,603	16,020	14,487	14,543
Mining.....	1,594	1,367	3,567	4,224	4,880
Contract construction.....	3,670	2,444	10,736	16,357	18,958
Manufacturing.....	16,820	16,320	52,870	77,221	87,116
Wholesale and retail trade....	12,367	12,920	37,926	49,646	54,894
Finance, insurance and real estate.....	3,751	2,892	7,031	11,361	13,300
Transportation, communications and public utilities.....	6,591	5,579	15,167	20,277	23,106
Services.....	8,518	7,706	20,062	28,335	33,495
Government.....	4,629	7,847	16,999	25,913	30,231
Other.....	181	173	567	842	968

1. Consists of wages and salaries, other labor income, and proprietors' income.

Table 24

DELAWARE RIVER SERVICE AREA  
 PERSONAL INCOME BY TYPE, SELECTED YEARS, 1929-1957  
 (Millions of dollars)

	1929	1940	1950	1955	1957
PERSONAL INCOME.....	18,620	15,762	38,373	51,167	57,632
By Type					
Wages and salaries.....	10,706	10,081	25,910	35,733	40,012
Other labor income.....	123	152	716	1,242	1,558
Proprietors' income.....	2,003	1,748	4,143	4,865	5,318
Farm.....	95	85	259	214	205
Nonfarm.....	1,908	1,661	3,884	4,651	5,113
Property income.....	5,558	3,395	5,870	7,529	8,623
Transfer payments.....	262	526	2,220	2,598	3,234
Less: Personal contributions for social insurance.....	31	140	486	860	1,113
CIVILIAN EARNINGS <sup>1</sup> / <sub>.....</sub>	12,801	11,935	30,450	41,246	46,548
By Industry					
Farms.....	160	141	382	332	325
Mining.....	69	47	119	105	121
Contract construction.....	878	467	1,713	2,406	2,629
Manufacturing.....	3,676	3,412	9,924	13,400	15,031
Wholesale and retail trade.....	2,817	2,732	7,121	8,741	9,690
Finance, insurance and real estate.....	1,079	906	1,885	2,774	3,110
Transportation, communications and public utilities.....	1,283	1,065	2,572	3,517	3,991
Services.....	2,112	1,912	4,378	6,037	6,921
Government.....	715	1,241	2,301	3,852	4,435
Other.....	12	12	57	83	95

1. For definition, see footnote to table 23.



Table 25

NEW YORK CITY METROPOLITAN AREA  
PERSONAL INCOME BY TYPE, SELECTED YEARS, 1929-1957  
(Millions of dollars)

	1929	1940	1950	1955	1957
PERSONAL INCOME.....	13,324	11,130	26,465	34,915	39,280
By Type					
Wages and salaries.....	7,616	7,082	17,988	24,502	27,422
Other labor income.....	91	111	488	825	1,026
Proprietors' income.....	1,448	1,224	2,747	3,249	3,566
Farm.....	12	13	46	37	41
Nonfarm.....	1,436	1,210	2,701	3,212	3,525
Property income.....	4,008	2,450	4,166	5,226	5,915
Transfer payments.....	185	366	1,419	1,717	2,142
Less: Personal contributions for social insurance.....	23	103	343	605	791
CIVILIAN EARNINGS 1/.....	9,140	8,394	21,088	28,328	31,803
By Industry					
Farms.....	29	29	76	65	71
Mining.....	11	11	28	39	46
Contract construction.....	662	329	1,121	1,516	1,642
Manufacturing.....	2,485	2,205	6,392	8,437	9,409
Wholesale and retail trade.....	2,088	2,057	5,294	6,427	7,119
Finance, insurance and real estate....	887	748	1,545	2,230	2,484
Transportation, communications and public utilities.....	917	777	1,827	2,502	2,854
Services.....	1,581	1,429	3,248	4,464	5,109
Government.....	477	805	1,527	2,607	3,025
Other.....	3	5	30	39	44

1. For definition, see footnote to table 23.

Table 26

NEW YORK CITY SUPPLEMENT  
 PERSONAL INCOME BY TYPE, SELECTED YEARS, 1929-1957  
 (Millions of dollars)

	1929	1940	1950	1955	1957
PERSONAL INCOME.....	742	695	1,769	2,549	2,902
By Type					
Wages and salaries.....	385	423	1,149	1,694	1,923
Other labor income.....	3	5	29	54	69
Proprietors' income.....	81	74	216	285	321
Farm.....	11	10	33	28	29
Nonfarm.....	70	63	183	257	292
Property income.....	262	173	299	424	475
Transfer payments.....	11	21	98	132	168
Less: Personal contributions for social insurance.....	1	6	22	40	54
CIVILIAN EARNINGS <sup>1</sup> / <sub>.....</sub>	460	488	1,345	1,971	2,255
By Industry					
Farms.....	21	18	49	42	44
Mining.....	1	1	2	3	3
Contract construction.....	25	23	89	153	180
Manufacturing.....	149	162	491	746	861
Wholesale and retail trade.....	85	83	240	324	364
Finance, insurance and real estate.....	18	14	36	67	83
Transportation, communications and public utilities.....	43	40	87	124	140
Services.....	77	77	186	287	328
Government.....	40	68	159	217	242
Other.....	2	2	5	9	10

1. For definition, see footnote to table 23.

Table 27

BETHLEHEM, ALLENTOWN, AND READING AREA  
PERSONAL INCOME BY TYPE, SELECTED YEARS, 1929-1957  
(Millions of dollars)

	1929	1940	1950	1955	1957
PERSONAL INCOME.....	494	467	1,215	1,542	1,764
By Type					
Wages and salaries.....	323	329	820	1,069	1,215
Other labor income.....	3	5	27	48	62
Proprietors' income.....	56	52	132	144	153
Farm.....	13	11	28	24	22
Nonfarm.....	44	40	104	120	131
Property income.....	105	71	165	216	256
Transfer payments.....	8	16	84	90	110
Less: Personal contributions for social insurance.....	1	4	14	25	32
CIVILIAN EARNINGS <sup>1</sup> / <sub>.....</sub>	382	385	977	1,255	1,424
By Industry					
Farms.....	17	16	42	37	35
Mining.....	4	2	6	4	4
Contract construction.....	20	11	50	76	84
Manufacturing.....	179	175	500	645	739
Wholesale and retail trade.....	62	56	154	190	212
Finance, insurance and real estate.....	10	9	21	35	41
Transportation, communications and public utilities.....	36	32	71	90	101
Services.....	34	35	81	108	125
Government.....	20	48	49	67	78
Other.....	1	1	2	3	4

1. For definition, see footnote to table 23.

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Table 28

TRENTON METROPOLITAN AREA  
 PERSONAL INCOME BY TYPE, SELECTED YEARS, 1929-1957  
 (Millions of dollars)

	1929	1940	1950	1955	1957
PERSONAL INCOME.....	143	145	436	577	657
By Type					
Wages and salaries.....	91	98	313	420	472
Other labor income.....	1	1	9	16	20
Proprietors' income.....	14	16	39	52	57
Farm.....	1	1	4	3	2
Nonfarm.....	14	15	36	49	55
Property income.....	36	27	51	66	81
Transfer payments.....	2	4	30	33	39
Less: Personal contributions for social insurance.....	2/	2	6	10	12
CIVILIAN EARNINGS <u>1</u> /.....	106	115	359	485	547
By Industry					
Farms.....	2	2	6	5	4
Mining.....	2/	2/	2/	2/	2/
Contract construction.....	12	6	20	29	33
Manufacturing.....	34	41	163	197	218
Wholesale and retail trade.....	19	21	60	82	89
Finance, insurance and real estate.....	3	3	9	16	19
Transportation, communications and public utilities.....	7	7	22	32	36
Services.....	15	15	41	62	74
Government.....	13	19	37	61	73
Other.....	2/	2/	2/	2/	1

1. For definition, see footnote to table 23.

2. Less than \$500,000.

Table 29

PHILADELPHIA METROPOLITAN AREA  
 PERSONAL INCOME BY TYPE, SELECTED YEARS, 1929-1957  
 (Millions of dollars)

	1929	1940	1950	1955	1957
PERSONAL INCOME.....	3,161	2,580	6,612	8,995	10,095
By Type					
Wages and salaries.....	1,846	1,692	4,481	6,428	7,105
Other labor income.....	19	24	126	235	292
Proprietors' income.....	304	284	713	807	876
Farm.....	22	19	50	44	41
Nonfarm.....	282	265	663	763	835
Property income.....	954	506	900	1,192	1,417
Transfer payments.....	42	95	472	475	579
Less: Personal contributions for social insurance.....	4	21	80	142	174
CIVILIAN EARNINGS <sup>1/</sup> .....	2,166	1,993	5,212	7,247	8,070
By Industry					
Farms.....	38	32	81	72	68
Mining.....	8	4	9	10	12
Contract construction.....	131	73	333	485	516
Manufacturing.....	703	691	1,932	2,689	2,988
Wholesale and retail trade.....	481	424	1,117	1,382	1,535
Finance, insurance and real estate.....	143	114	234	359	408
Transportation, communications and public utilities.....	227	164	447	616	690
Services.....	318	278	646	885	1,015
Government.....	116	212	404	734	821
Other.....	2	2	9	15	17

1. For definition, see footnote to table 23.

Table 30

WILMINGTON METROPOLITAN AREA  
 PERSONAL INCOME BY TYPE, SELECTED YEARS, 1929-1957  
 (Millions of dollars)

	1929	1940	1950	1955	1957
PERSONAL INCOME.....	228	258	633	960	1,114
By Type					
Wages and salaries.....	122	146	398	622	715
Other labor income.....	1	2	13	28	39
Proprietors' income.....	17	18	51	61	64
Farm.....	3	3	8	5	3
Nonfarm.....	15	15	42	56	61
Property income.....	86	90	155	230	270
Transfer payments.....	3	4	23	32	41
Less: Personal contributions for social insurance.....	2/	2	6	12	15
CIVILIAN EARNINGS 1/.....	140	164	458	699	806
By Industry					
Farms.....	6	5	13	11	9
Mining.....	2/	1	2/	2/	2/
Contract construction.....	11	11	37	58	68
Manufacturing.....	60	72	217	358	416
Wholesale and retail trade.....	19	25	67	95	106
Finance, insurance and real estate.....	6	7	16	25	26
Transportation, communications and public utilities.....	13	14	39	48	53
Services.....	17	18	43	67	79
Government.....	6	11	25	36	48
Other.....	2/	2/	2/	2/	1

1. For definition, see footnote to table 23.

2. Less than \$500,000.

Table 31

UPPER BASIN AREA  
 PERSONAL INCOME BY TYPE, SELECTED YEARS, 1929-1957  
 (Millions of dollars)

	1929	1940	1950	1955	1957
PERSONAL INCOME.....	314	282	662	777	902
By Type					
Wages and salaries.....	194	187	406	493	574
Other labor income.....	2	2	14	21	27
Proprietors' income.....	49	43	119	127	138
Farm.....	20	14	40	33	34
Nonfarm.....	29	30	80	94	104
Property income.....	64	39	71	88	104
Transfer payments.....	7	14	59	63	78
Less: Personal contributions for social insurance.....	1	2	7	14	19
CIVILIAN EARNINGS <sup>1</sup> / <sub>1</sub> .....	244	232	537	636	731
By Industry					
Farms.....	26	19	52	44	45
Mining.....	45	28	71	45	52
Contract construction.....	8	6	29	38	45
Manufacturing.....	44	38	117	184	226
Wholesale and retail trade.....	31	31	84	100	109
Finance, insurance and real estate.....	6	5	11	18	21
Transportation, communications and public utilities.....	25	19	44	55	60
Services.....	33	33	68	85	97
Government.....	25	52	58	61	70
Other.....	1	1	3	5	6

1. For definition, see footnote to table 23.



Table 32

SOUTHERN BASIN AND COASTAL AREA  
 PERSONAL INCOME BY TYPE, SELECTED YEARS, 1929-1957  
 (Millions of dollars)

	1929	1940	1950	1955	1957
PERSONAL INCOME.....	213	205	582	792	918
By Type					
Wages and salaries.....	129	126	355	505	586
Other labor income.....	1	1	9	16	23
Proprietors' income.....	34	39	126	140	143
Farm.....	15	15	50	40	33
Nonfarm.....	19	24	76	100	110
Property income.....	45	34	63	87	105
Transfer payments.....	4	7	35	57	77
Less: Personal contributions for social insurance.....	2/	2	7	12	16
CIVILIAN EARNINGS 1/.....	162	163	474	624	712
By Industry					
Farms.....	21	20	63	57	49
Mining.....	1	1	2	3	4
Contract construction.....	11	7	33	51	61
Manufacturing.....	23	29	113	144	174
Wholesale and retail trade.....	32	35	103	140	156
Finance, insurance and real estate.....	5	5	12	23	28
Transportation, communications and public utilities.....	14	12	35	50	57
Services.....	36	27	66	79	94
Government.....	16	26	41	68	77
Other.....	3	2	7	10	12

1. For definition, see footnote to table 23.

2. Less than \$500,000.

INDUSTRIAL PATTERN

of the

DELAWARE RIVER SERVICE AREA

The economic growth of the Delaware Area earlier reviewed has been associated with a large increase in population and employment. After 1900 the population growth rate of the Delaware River Service Area was greater than that of the remainder of the Nation in the first quarter century, and less subsequently (see Table 33).

Population for all of the major sub-regions of the Area has also expanded, though at differential rates for the entire period and at varying rates in the earlier and later years.

From 1930 to 1955, the Upper Basin Area showed practically no change (see Table 38). The Wilmington Metropolitan Area and the New York City Metropolitan Area Supplement experienced growth rates well above the one-third average for the United States; the Southern Basin and Coastal Area also expanded at a somewhat faster rate and the Trenton Metropolitan Area at about the same rate as the Nation. The population growth rates in the large New York and

Philadelphia Metropolitan Areas were not far below the national average, and the Bethlehem-Allentown-Reading Metropolitan Area increased by one-fifth.

The increase in employment in the first half of the period was at a higher rate than the U. S. average, and was followed by a less-than-average rise for the more recent quarter century. Differential employment growth among geographic areas is partly a function of the varying growth rates of individual industries, and the relative importance of fast and slow growing industries. The fact that agriculture has long been a slow-growing industry and that it is relatively much less important in the Delaware Area than in the Nation as a whole is a major factor accounting for the differing growth rates of total employment in the Delaware River Service Area and the United States.

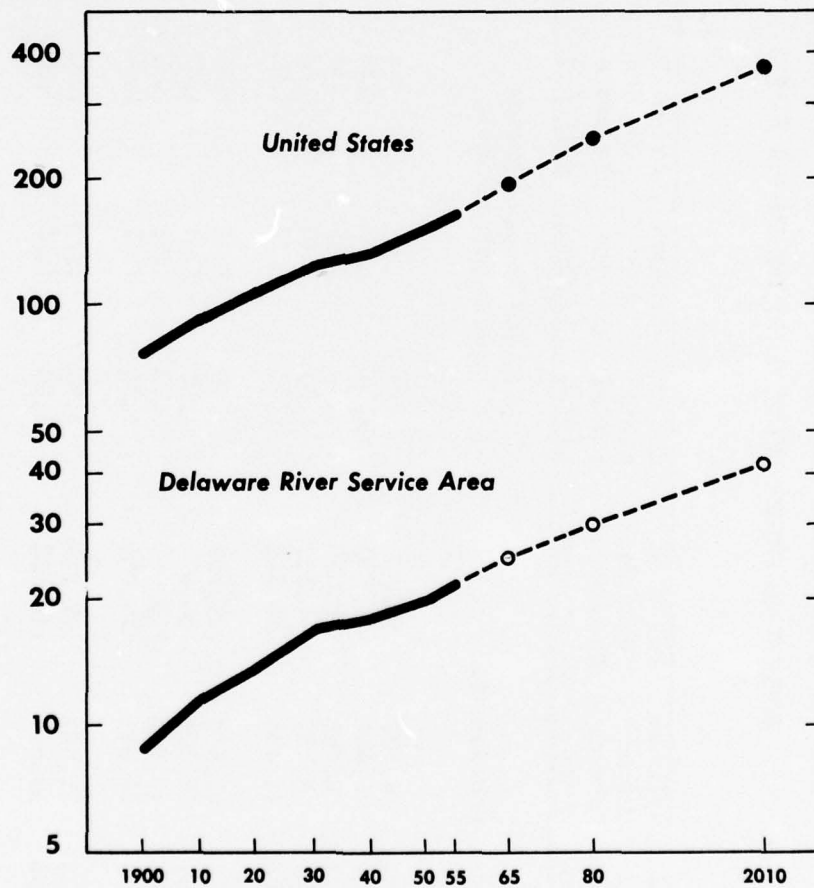
If the effects of agriculture are eliminated and the growth of only the nonagricultural economy is observed, the historical pattern is altered (see Table 45). In 1910, for example, when agricultural employment in the United States, as measured by decennial data, reached its peak, only 5 percent of total employment in the Delaware Area was in agriculture, forestry and fishing, compared with one-third for the U. S. average. The subsequent decline in agricultural employment had only a limited effect in the Area, even though it was a major influence nationally.

Figure 11

## Population

### United States and Delaware River Service Area

Millions (ratio scale)



U. S. Department of Commerce, Office of Business Economics

Data: See Tables 1, 2, & 33



Table 33

DELAWARE RIVER SERVICE AREA  
POPULATION GROWTH RELATIVE TO THE UNITED STATES, 1870-1956

	Conti- nental United States	Delaware River Service Area	All U. S. Outside Delaware River Area	Conti- nental United States	Delaware River Service Area	All U. S. Outside Delaware River Area	Conti- nental United States	Delaware River Service Area	All U. S. Outside Delaware River Area
	(Thousands)			(Average annual percent growth per period)			(Percent of U. S. total)		
1870	39,818	4,507	35,312	--	--	--	100	11.32	88.68
1880	50,156	5,486	44,670	2.34	1.98	2.38	100	10.94	89.06
1890	62,948	6,852	56,096	2.30	2.25	2.31	100	10.89	89.11
1900	75,995	8,737	67,258	1.90	2.46	1.83	100	11.50	88.50
1910	91,972	11,424	80,548	1.92	2.72	1.82	100	12.42	87.58
1920	105,711	13,555	92,156	1.40	1.73	1.35	100	12.82	87.18
1930	122,775	16,705	106,071	1.50	2.11	1.42	100	13.61	86.39
1940	131,669	17,715	113,953	.70	.58	.72	100	13.45	86.55
1950	150,697	19,811	130,886	1.36	1.12	1.40	100	13.15	86.85
1955	164,303	21,589	142,714	1.74	1.73	1.75	100	13.14	86.86
1956	167,259	21,877	145,382	1.80	1.33	1.87	100	13.08	86.92

Employment in nonagricultural industries increased at about the same rate in the Delaware Area as in the United States from 1900 to 1930, with the Area accounting for about  $18\frac{1}{2}$  percent of the national total in both years.

In this period, DRSA nonagricultural expansion matched that of the Nation because although its manufacturing, mining, and construction industries were growing less rapidly than in the Nation, its service-type industries were expanding faster. Since 1930, employment in the Area has continued to increase, with the rate of growth of the major industry groups below the corresponding national growth rates.

#### Historical Employment Patterns

Several features of the changes in the economy of the Area compared with changes in the U. S. economy help to throw light on the employment projections which have been developed as one measure helpful in evaluating future water use. One obvious feature, as reflected in Tables 45 and 46, is that industrial growth was quite general among all major industries, although at somewhat lesser rates than the growth of the corresponding industries of the United States. There were a few exceptions such as, for example, in chemicals. This regional differential in growth rates is a general facet of the progress of the United States which the OBE has

noted in all its regional studies.<sup>4/</sup> It stems from the fact that the older and more highly developed regions of the country -- for example, those in the northeast quarter -- account for the major share of economic activity, and hence changes there are relatively less than in the newly developed areas of the South and West.

A second significant feature of recent economic changes in the Service Area relates to the differential growth of its non-commodity-producing industries which employ roughly half again as many persons as those producing commodities. Between 1930 and 1955, in relation to the growth rates of the corresponding industries in the entire Nation, nonagricultural commodity producing industries in the DRSA grew at 51 percent of the national growth rate as compared with 47 percent in the service-type industries.

Finally, manufacturing in the DRSA registered the highest rate of growth of major industry groups shown in Table 46. As a result, the Delaware Area maintained its status of having a higher than average concentration of manufacturing.

#### Employment Projections

The employment projections for the Delaware Area by major industry groups are given in Table 35. The projections were developed on the basis of the national assumptions used, and by a

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<sup>4/</sup> See, for example, Charles A. R. Wardwell, REGIONAL TRENDS IN THE UNITED STATES ECONOMY, U. S. Government Printing Office, Washington, D. C., 1951; and Charles F. Schwartz and Robert E. Graham, Jr., op. cit.

Table 34

DELAWARE RIVER SERVICE AREA  
EMPLOYMENT BY INDUSTRIES, 1930-1955  
(Thousands)

	April 1930	April 1940	April 1950	1955
All industries.....	7,309	6,613	8,102	9,073
Commodity producing industries, total.....	3,086	2,567	3,232	3,643
Manufacturing, total.....	2,197	2,044	2,596	2,907
Food & kindred products.....	135	158	189	215
Chemicals & allied products...	102	118	166	190
Petroleum & coal products.....	--	43	58	65
Primary metal industries.....	67	67	119	146
Paper & allied products.....	38	53	72	80
Noncommodity producing industries, total.....	4,223	4,045	4,870	5,430

Table 35

DELAWARE RIVER SERVICE AREA  
EMPLOYMENT PROJECTIONS BY INDUSTRIES, 1965-2010  
(Thousands)

	1965	1980	2010
All industries.....	10,300	12,400	18,000
Commodity producing industries, total.....	4,200	5,100	7,400
Manufacturing, total.....	3,390	4,210	6,100
Food & kindred products.....	230	270	400
Chemicals & allied products...	235	325	630
Petroleum & coal products.....	75	90	145
Primary metal industries.....	180	240	400
Paper & allied products.....	100	150	300
Noncommodity producing industries, total.....	6,100	7,300	10,600



consideration of the differential growth rates of the individual industry groups in the Area relative to the national totals.

Here we need to stress that the Area totals have greater validity than do any of the smaller parts. It was considered necessary, however, that these sub-area projections should be made as a general guide, despite the obvious limitations that we have stressed earlier in this report. Consideration of just one industrial project -- the steel mill at Morrisville, or the various new public works such as the New Jersey Turnpike or the Delaware Bridge -- makes clear the increased hazards as one moves from the general to the specific.

We have not attempted other than a broad industry grouping, since it was agreed at the initiation of the study that this would provide an adequate working basis. These industry employment estimates, however, used in conjunction with water consumption data for corresponding geographic areas, should provide a useful basis for projecting certain types of demand for water.

#### Economic Patterns of Sub-Regions

The comparative growth rates have varied. Some part of these differences is attributable to the relative importance in each region of the faster and slower growing industries. Examination of the economic patterns of the several sub-regions, according to the relative distribution of employment among major industry groups, reveals these differences. It is also clear from the tables that

unique movements developed in the past quarter century in the sub-areas.

Employment projections for the sub-regions, based upon differential employment growth in the industry groups from 1930 to 1955, reflect the particular pattern of change of each sub-area (see Tables 36 and 37). As already indicated, the projections are based on these past relations plus modifications based on a judgment with respect to the effects of various underlying factors and of the shifting relative importance of individual industry groups in a sub-area.

Between 1930 and 1955 employment in the metropolitan areas of New York and Philadelphia each increased by a little more than one-fifth. This rise was somewhat less than the increase of nearly one-fourth for the entire Area. All of the other sub-regions, except the Upper Basin, showed above-average increases. The New York sub-region has the highest proportion of workers concentrated in the slower-growing service-type industries. Also its manufacturing is heavily concentrated in the textile and apparel industries which have not expanded much. Philadelphia differs markedly from New York by having a much smaller proportion of service-type industries, and a correspondingly larger proportion of commodity-producing industries.

The Upper Basin has close to the largest share of agriculture of any of the sub-areas, and has a concentration of employment in anthracite mining -- an industry that has declined sharply. It has

Table 36

DELAWARE RIVER SERVICE AREA  
EMPLOYMENT BY SUB-REGIONS, 1930-1955  
(Thousands)

	April 1930	April 1940	April 1950	1955
CONTINENTAL UNITED STATES..	48,833	45,166	57,222	65,250
Delaware River Service Area.....	7,309	6,613	8,102	9,073
New York City Metropolitan....	4,859	4,421	5,338	5,897
New York City Supplement.....	318	322	418	495
Bethlehem-Allentown-Reading...	264	254	312	357
Trenton Metropolitan.....	77	76	98	110
Philadelphia Metropolitan.....	1,365	1,165	1,467	1,671
Wilmington Metropolitan.....	84	86	106	136
Upper Basin.....	202	165	201	214
Southern Basin and Coastal....	140	123	161	193

Table 37

DELAWARE RIVER SERVICE AREA  
EMPLOYMENT PROJECTIONS BY SUB-REGIONS, 1965-2010  
(Thousands)

	1965	1980	2010
UNITED STATES.....	76,000	97,000	151,000
Delaware River Service Area.....	10,300	12,400	18,000
New York City Metropolitan....	6,600	7,800	11,000
New York City Supplement.....	600	800	1,400
Bethlehem-Allentown-Reading...	400	470	700
Trenton Metropolitan.....	130	170	280
Philadelphia Metropolitan.....	1,910	2,300	3,300
Wilmington Metropolitan.....	180	240	420
Upper Basin.....	240	280	380
Southern Basin and Coastal....	240	340	540

the smallest share of manufacturing of any sub-region. As mining declined, there was a marked shift of employment into manufacturing and service-type industries. We have assumed in the projections that the rise in employment will be somewhat more marked than in the 1930-1955 period because there is reason to believe that the depressing effect of the decline in the anthracite coal industry may have been largely exhausted.

The Bethlehem-Allentown-Reading sub-region has a greater concentration of its employment in manufacturing and in commodity producing industries than any of the other sub-regions. It is the only one of them where the long-term trend of manufacturing growth exceeded the national average. Since 1939 the expansion of manufacturing employment has lagged. This was due largely to the fact, as shown by the 1954 Census of Manufactures, that nearly one-third of the manufacturing employees were concentrated in the relatively slow-growing industries, textiles and apparel, as compared with one-seventh for the entire United States. In view of the importance of manufacturing in this sub-region, we projected its total employment growth at about the same rate as that for the entire Area.

Of the four sub-regions for which more-than-average growth is projected, two are metropolitan areas and two are non-metropolitan areas with substantial blocs of rural population. The New York Supplement grew much faster than the regional average from 1930 to 1955. The differential growth trends of the individual industry



groups for this period generally reflected this higher average rate of growth. One reason for assuming that this faster rate will continue is the expectation that this sub-region will receive considerable "spillover" from the adjoining Metropolitan Area.

For the Trenton Metropolitan Area, the projection of a somewhat more rapid expansion was based on growth trends since 1930. The assumption that this would continue is believed to be warranted by a number of considerations involving favorable transportation facilities and proximity to areas of substantial industrial expansion.

The growth of the Wilmington Metropolitan and the Southern Basin and Coastal Areas may be expected to be affected by much the same favorable factors. The projections of employment in these regions also take into account the recent differential growth trends of the major industry groups. The new bridge across Chesapeake Bay and the Memorial Bridge across the Delaware River should stimulate industries in both areas that rely to an important extent on highway transportation. It is assumed that both will attract industries that are large water users and also seek deep water transportation adjacent to good highway and railroad networks. The new bridges and the new highway network already built, and those that will be added in the coming years, can hardly fail to give an appreciable stimulus to the important recreation industry, and to other noncommodity-producing industries of the Southern Basin and Coastal Area.

#### Population: Recent Changes and Projections

The population projection of the DRSA which we have used suggests

Table 38

DELAWARE RIVER SERVICE AREA  
POPULATION BY SUB-REGIONS, 1870-1956

	Delaware River Service Area, total	New York City Met.	New York City Supple- ment	Bethlehem- Allentown- Reading	Trenton Met.
Population (thousands)					
1870	4,507	2,176	321	296	46
1880	5,486	2,795	341	334	58
1890	6,852	3,678	410	370	80
1900	8,737	5,049	466	425	95
1910	11,424	7,049	558	506	126
1920	13,555	8,491	648	580	160
1930	16,705	10,859	783	658	187
1940	17,715	11,661	857	675	197
1950	19,811	12,912	1,039	736	230
1955	21,589	13,851	1,221	798	250
1956	21,877	14,049	1,227	799	253

	Phila- delphia Met.	Wil- mington Met.	Upper Basin	Southern Basin & Coastal
Population (thousands)				
1870	1,059	87	389	132
1880	1,296	102	410	150
1890	1,580	122	439	173
1900	1,892	135	469	206
1910	2,268	150	519	247
1920	2,714	185	515	262
1930	3,137	198	547	335
1940	3,200	222	553	351
1950	3,671	268	541	414
1955	4,121	329	551	469
1956	4,157	346	551	494

a rise from  $21\frac{1}{2}$  million in 1955 to 25 million in 1965, to 30 million in 1980 and to a figure nearly double the 1955 total by the terminal date of our survey. The rate of increase over the entire time span is 1.2 percent per year, intermediate between the 1 percent rate of the past 25 years and the past 50 year rate of  $1\frac{1}{2}$  percent.

The projections for the sub-regions -- and here again we warn of the probable high margin of error of some particular estimate -- were obtained from their relationship to the U. S. population trend, and to the general economic activity of the sub-region based largely upon the analysis of employment. The general growth pattern of each sub-region in the past two or three decades was projected into the future, but in one or two instances substantive variations from recent trends are projected.

Of the eight sub-regions, the population for four is projected to grow at a more rapid rate than the U. S. average. All of these -- Wilmington, Southern Basin and Coastal, Trenton, and New York City Metropolitan Supplement -- have experienced rapid population growth in the recent past. The other four sub-regions -- which include the larger cities and 90 percent of the population of the area -- are projected to grow at a somewhat lesser rate than the U. S. average, with one, the Upper Basin, calculated to be well below average.

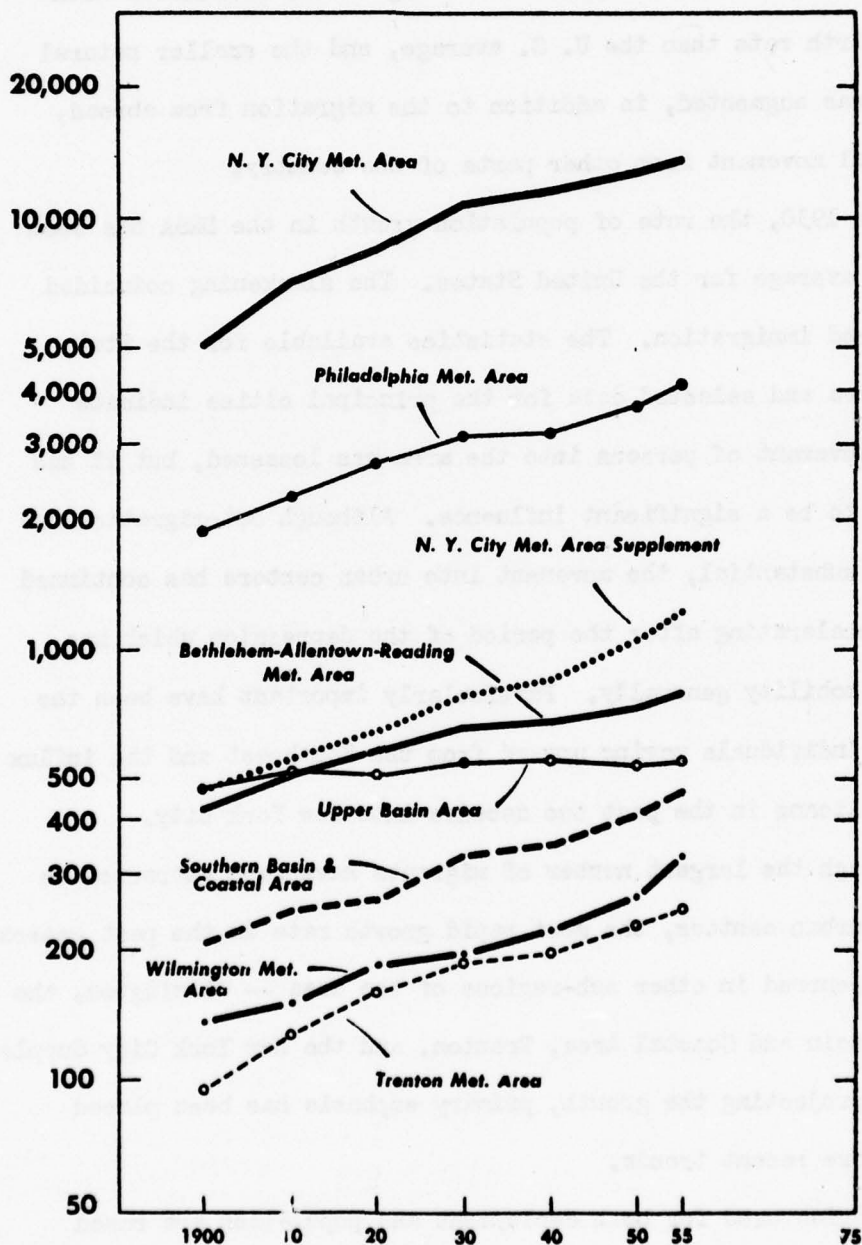
In the past half century the population of the DDSA has more than doubled, exceeding slightly the average rate of growth for the United States as a whole. This period is divided into two parts of about equal duration which have different rates of growth. Through

Figure 12

# Population

## Delaware River Service Area Sub-Regions

Thousands (ratio scale)



U. S. Department of Commerce, Office of Business Economics

Data: See Table 38



the decade of the 1920's the growth rate was appreciably higher than that for the United States. These were years of heavy immigration from abroad, and this area obtained a greater proportion of its population growth from the foreign born than other parts of the country. The highly urbanized character of this region was associated with a lower birth rate than the U. S. average, and the smaller natural increase was augmented, in addition to the migration from abroad, by internal movement from other parts of the country.

Since 1930, the rate of population growth in the DRSA has been below the average for the United States. The slackening coincided with reduced immigration. The statistics available for the States of this area and selected data for the principal cities indicate that the movement of persons into the area has lessened, but it has continued to be a significant influence. Although out-migration has also been substantial, the movement into urban centers has continued strong, accelerating after the period of the depression which has curtailed mobility generally. Particularly important have been the stream of individuals moving upward from the Southeast and the influx of Puerto Ricans in the past two decades into New York City.

Although the largest number of migrants have been attracted to the large urban centers, the most rapid growth rate in the past generation has occurred in other sub-regions of the area -- Wilmington, the Southern Basin and Coastal Area, Trenton, and the New York City Supplement. In projecting the growth, primary emphasis has been placed upon the more recent trends.

The series used for both employment and population are based upon place of residence. Employment opportunities based upon an

Table 39

DELAWARE RIVER SERVICE AREA  
POPULATION BY SUB-REGIONS, 1930-1955

(Thousands)

	1930	1940	1950	1955
CONTINENTAL UNITED STATES..	122,775	131,669	150,697	164,303
Delaware River Service Area.....	16,705	17,715	19,811	21,589
New York City Metropolitan....	10,859	11,661	12,912	13,851
New York City Supplement.....	783	857	1,039	1,221
Bethlehem-Allentown-Reading...	658	675	736	798
Trenton Metropolitan.....	187	197	230	250
Philadelphia Metropolitan.....	3,137	3,200	3,671	4,121
Wilmington Metropolitan.....	198	222	268	329
Upper Basin.....	547	553	541	551
Southern Basin and Coastal....	335	351	414	469

Table 40

DELAWARE RIVER SERVICE AREA  
POPULATION PROJECTIONS BY SUB-REGIONS, 1965-2010

(Thousands)

	1965	1980	2010
UNITED STATES.....	195,000	248,000	370,000
Delaware River Service Area.....	25,000	30,000	42,000
New York City Metropolitan....	16,000	18,500	25,000
New York City Supplement.....	1,500	2,000	3,400
Bethlehem-Allentown-Reading...	900	1,100	1,550
Trenton Metropolitan.....	300	400	650
Philadelphia Metropolitan.....	4,800	5,800	7,900
Wilmington Metropolitan.....	450	600	1,000
Upper Basin.....	650	750	950
Southern Basin and Coastal....	600	850	1,300

analysis by industries has been used as the chief reliance, and population estimates are consistent with the employment projections.

We have not attempted to evaluate any limiting factors in the projections which might impede or prevent the assumed growth. We know of none but, if there be such factors, this would be a project for others to study and evaluate after specification, if necessary for particular needs or purposes.

#### Sub-Region Trends

Estimates obtained from the Bureau of the Census of components of population change for the sub-regions from 1940 to 1956 are shown in Tables 41 and 42. The components of population growth for this period show a natural increase, i.e., excess of births over deaths, for each of the sub-regions. Net migration occurred into each sub-region except the Upper Basin area.

In the three areas which registered the more rapid rates of growth -- Wilmington, the New York City Supplement, and the Southern Basin and Coastal Area -- migration accounted for a larger portion of the rise than the natural increase. In each of these areas the pattern of population growth is similar and diverges from the average for the DESA. During the few decades prior to 1930, when the DESA growth exceeded that of the U. S., these sub-regions grew at about the same rate as the U. S. average, whereas in the period since then they have grown more rapidly.

Table 41

DELAWARE RIVER SERVICE AREA  
COMPONENTS OF POPULATION CHANGE  
(Thousands)

	Net change	1940 to 1950	
		Components of change	
		Natural increase	Net migration
Delaware River Service Area.....	2,109	1,473	635
New York City Metropolitan....	1,253	967	286
New York City Supplement.....	197	65	132
Bethlehem-Allentown-Reading...	60	51	9
Trenton Metropolitan.....	30	16	14
Philadelphia Metropolitan.....	464	291	172
Wilmington Metropolitan.....	48	28	20
Upper Basin.....	- 8	32	-40
Southern Basin and Coastal....	65	23	42

Table 42

DELAWARE RIVER SERVICE AREA  
COMPONENTS OF POPULATION CHANGE  
(Thousands)

	Net change	1950 to 1956	
		Components of change	
		Natural increase	Net migration
Delaware River Service Area.....	2,065	1,408	657
New York City Metropolitan....	1,137	891	246
New York City Supplement.....	188	79	109
Bethlehem-Allentown-Reading...	63	44	19
Trenton Metropolitan.....	23	17	6
Philadelphia Metropolitan.....	486	292	194
Wilmington Metropolitan.....	77	30	47
Upper Basin.....	10	25	-15
Southern Basin and Coastal....	81	29	52



Although the decennial data available do not permit precise timing of changes in the rate of growth, the pick up in growth evidently came earlier for Wilmington and the New York Supplement areas than for the Southern Basin and Coastal Area. The Wilmington Metropolitan Area grew relatively less than the national average to 1910, at which time it had reached a population of 150,000. Then followed an on-and-off period, with a pick up in the decade following 1910, and a slackening in the 1920's in relation to the national average. Since 1940, the population growth has been strong, rising 50 percent in less than two decades to 350,000 in 1956.

The Southern Basin and Coastal Area in the period prior to 1920 grew less rapidly than the national average, but since has grown more rapidly with a tendency for the rate to rise in the more recent years. Improved transportation facilities for the Delaware Eastern Shore counties has been an important factor in reducing transport costs to markets to the west and south.

The Trenton Metropolitan Area has more than kept pace with the rate of growth in the U. S. population in the past half century. Trenton growth was appreciably higher for a number of decades prior to 1920, and has been about equal to the national average since that time. The projection for the area assumes an appreciably higher growth than the average projected for the Delaware Area.

For the New York City Supplement Area, population growth has been determined chiefly by the relationship of the region to the New York City Metropolitan Area. In the period before 1920, the Supplement Area grew less rapidly than did New York City. During

these years the distance from New York City -- as short as it was in miles -- was a handicap. The suburbs adjacent to the city (within the present Metropolitan Area) were experiencing rapid growth which continued to accelerate through the decade of the 1920's. The Supplement Area held its own during the 1920's, i.e., in relation to New York City Metropolitan Area -- growing from 650,000 to 785,000 in this decade.

Since then the New York City Supplement has grown more rapidly than either the New York City Metropolitan Area or the United States. It has about matched the growth rate of the immediate New York City suburbs. The population of the Supplement Area reached 1 million in 1950, and then rose one-fifth by 1956. A continued rapid rise is projected for this Area which is becoming more closely integrated with the Metropolitan Area. The extent of the future spill-over from the central city area will depend upon a number of inter-related developments including transportation arrangements and the type of housing development.

About two-thirds of the population in the DSEA live in the New York Metropolitan Area. New York City grew at a more rapid rate than the United States through 1930, with the peak rate of growth for a decade since 1870 attained in the 1900-1910 period when foreign-born immigration exerted its greatest influence. But the growth rate continued high through the 1920's. The growth since then has been largely in the suburbs, but it has remained substantial. The population grew 1 million between 1950 and 1956

to a total of 14 million. Growth at somewhat less than the national average rate has been projected for the next half century.

#### Density Problems

The principal density problems for the DRSa are present in the New York City Area. For this sub-region, the implication of the projections is that the average density is projected to rise from around 3,500 persons per square mile at present to 6,000 persons per square mile in 2010 for all land in the area.

These average figures conceal the particular nature of the land development which has taken place in the New York Metropolitan Area in the past half-century. The land that has been newly "developed" in a given period has been characterized by a lower or declining density compared with earlier developments -- the well known "horizontal" tendency, dubbed "urban sprawl". Thus, between 1900 and 1940 the population of the area a little more than doubled but the intensively developed land area quadrupled. Again between 1940 and 1954, the population rose one-fifth, but the intensively developed land area almost doubled.

Paradoxically, the developed land area in the New York Metropolitan Area has housed a declining number of persons per square mile over the past half-century, but the area has expanded rapidly. Our projection does not imply that this horizontal movement will continue uninterrupted for the next half-century. In fact, such a trend would exhaust the available land in the Metropolitan Area

well before 2010 and would imply more spill-over into the adjoining areas than we have assumed.

The Philadelphia Metropolitan Area contained 4.2 million persons in 1956, one-fifth of the total for the DMSA. Since 1900, the growth rate of Philadelphia has averaged about the same as that for the United States. The chief divergence was a greater slackening in growth during the decade of the 1930's and a somewhat more rapid increase since that time, especially in the past few years. The interpretation of this growth pattern with respect to future prospects depends upon the relative permanency of the factors which have increased the rate of population growth in recent years in relation to that of the Nation. The projection made assumes that the Philadelphia Metropolitan Area will grow at about as rapid a rate as the DMSA and moderately less rapidly than the United States.

The combined standard metropolitan areas of Bethlehem-Allentown-Easton and of Reading are grouped together along with Hunterdon County, New Jersey, into one area for the purpose of this report and referred to as Bethlehem-Allentown-Reading. In 1956, this area had 800,000 persons. Since 1950 the rate of growth in population in the area has approached that of the U. S., but it was appreciably less in earlier years. The lag in growth continued during most of the period between World War I and World War II and was most pronounced in Reading, but the other two principal cities in the area also experienced long periods of little growth. In the next fifty years population in this area is projected to nearly double.



The Upper Basin position has been one of approximate population stability in the past few decades. In recent years part of the natural increase has been offset by net migration from the area. A part of the weakness in economic activity in the area is attributable to declining coal mining operations. Manufacturing has done better. Continued extension in manufacturing is implied in the projection of the population rise ahead.

#### Households

One aspect of the general population which is of interest for a number of uses, and which has been requested for this general economic survey, is the number of households.

In the past 25 years, the average number of persons per household has shown a considerable decline. Accordingly, the number of households has shown a greater relative rise than total population both for the United States and for the Delaware River Service Area.

Aside from the birth rate, the influences which have led to the reduction in the size of household may have largely spent their force, especially the "undoubling" which has taken place in the past several years following the general consolidation of households which occurred both in the depression years before World War II and during and immediately after the war. The assumption is made, then, that the average size of households will

Table 43

DELAWARE RIVER SERVICE AREA  
NUMBER OF HOUSEHOLDS BY SUB-REGIONS, 1930-1955  
(Thousands)

	1930	1940	1950	1955
UNITED STATES.....	29,905	34,949	42,857	47,788
Delaware River Service Area.....	4,076	4,724	5,711	6,499
New York City Metropolitan....	2,668	3,116	3,777	4,286
New York City Supplement.....	195	224	292	340
Bethlehem-Allentown-Reading...	161	177	209	228
Trenton Metropolitan.....	43	49	59	69
Philadelphia Metropolitan.....	742	831	1,019	1,163
Wilmington Metropolitan.....	47	57	75	94
Upper Basin.....	131	142	155	163
Southern Basin and Coastal....	89	99	125	156

Table 44

DELAWARE RIVER SERVICE AREA  
PROJECTIONS OF THE  
NUMBER OF HOUSEHOLDS BY SUB-REGIONS, 1965-2010  
(Thousands)

	1965	1980	2010
UNITED STATES.....	57,000	74,000	117,000
Delaware River Service Area.....	7,400	9,100	13,500
New York City Metropolitan....	4,800	5,800	8,400
New York City Supplement.....	420	570	1,000
Bethlehem-Allentown-Reading...	260	310	460
Trenton Metropolitan.....	80	110	180
Philadelphia Metropolitan.....	1,350	1,650	2,400
Wilmington Metropolitan.....	120	170	300
Upper Basin.....	190	220	300
Southern Basin and Coastal....	200	280	460

show little change in the next two or three decades and then will decline somewhat reflecting the assumed trend in the birth rate. The number of households in the DRSA is projected to double during the next half century.

#### Water Use Estimation

As indicated in the introduction, the analysis and projections of the growth of the Delaware River Service Area were to aid the Corps of Engineers in their projection of future water requirements. The technical phases of appraising probable future water supplies, water quality, and demand for water by different types of users is covered in other parts of the Corps of Engineers' project.

Rapidly increasing per capita gross water consumption is clearly a part of the economic expansion of the United States. To the extent that rising water use per capita is a part of our mounting standard of living, we may expect a continuation in the growth of per capita use of water.

Estimated total gross water use, excluding irrigation, in the United States in 1955 was at the average of 145 billion gallons per day, or 884 gallons per capita. Per capita daily average consumption in the Delaware River Basin in 1955 was estimated to be about 920 gallons per day, exclusive of irrigation, in the report

by J. C. Kammerer of the United States Department of the Interior, Geological Survey, January 1957. Hence, for the purpose of deriving estimates of the general order of magnitude of future water requirements in the Delaware River Service Area, it seems to us that it would be reasonable to assume that they will follow a pattern closely related to the rate of growth of the Nation.

If the data developed for the Corps of Engineers by the Public Health Service provide a tabulation of the past growth of water use in the Delaware River Service Area, it should be possible to work out the relationship of water requirements to the broad measure of economic growth of the Area -- personal income in constant dollars. Such requirements are clearly related to the basic growth in the Nation and in the region. The related data on population, households, and employment should provide additional bases for estimating requirements for particular types of water use.



Table 45

## EMPLOYMENT IN MAJOR INDUSTRY GROUPS, 1900, 1930, AND 1955

(Millions)

	1900		1930		1930 as % 1900	1955		1955 as % 1930
	Number	% of total	Number	% of total		Number	% of total	
<u>United States:</u>								
All industries, total..	29.29	100.0	48.83	100.0	166.7	65.25	100.0	133.6
All commodity pro- ducing industries...	17.63	60.2	26.42	54.1	149.9	29.17	44.7	110.4
Agri., forestry, fishing.....	10.51	35.9	10.75	22.0	102.3	6.86	10.5	63.8
All other commodity producing indus- tries.....	7.11	24.3	15.67	32.1	220.3	22.31	34.2	142.4
All noncommodity pro- ducing industries...	11.66	39.8	22.41	45.9	192.2	36.08	55.3	161.0
All industries except agri., forestry, fishing.....	18.77	100.0	38.08	100.0	202.8	58.39	100.0	153.3
Commodity producing..	7.11	37.9	15.67	41.2	220.3	22.31	38.2	142.4
Noncommodity pro- ducing.....	11.66	62.1	22.41	58.8	192.2	36.08	61.8	161.0
<u>Delaware River Service Area:</u>								
All industries, total..	3.71	100.0	7.31	100.0	196.8	9.07	100.0	124.1
All commodity pro- ducing industries...	1.65	44.4	3.09	42.2	187.1	3.64	40.2	118.1
Agri., forestry, fishing.....	.25	5.8	.21	2.9	83.0	.15	1.6	71.0
All other commodity producing indus- tries.....	1.40	37.6	2.88	39.3	206.0	3.50	38.5	121.5
All noncommodity pro- ducing industries...	2.07	55.6	4.22	57.8	204.5	5.43	59.8	128.6
All industries except agri., forestry, fishing.....	3.46	100.0	7.10	100.0	205.2	8.92	100.0	125.7
Commodity producing..	1.40	40.3	2.88	40.5	206.0	3.50	39.2	121.5
Noncommodity pro- ducing.....	2.07	59.7	4.22	59.5	204.5	5.43	60.8	128.6

Table 46

NONAGRICULTURAL EMPLOYMENT  
IN SELECTED INDUSTRY GROUPS, 1930 AND 1955  
(Thousands)

	1930		1955		
	Number	% of total	Number	% of total	1955 as % 1930
<u>United States:</u>					
All nonagricultural industries, total.....	38,350	100.0	58,521	100.0	152.6
All nonagricultural commodity producing industries.....	15,941	41.6	22,438	38.3	140.8
Manufacturing, total.....	11,498	30.0	17,121	29.3	148.9
Food & kindred products.....	907	2.4	1,531	2.6	168.8
Chemicals & allied products..	621	1.6	804	1.4	129.5
Petroleum & coal products....	--	--	315	.5	--
Primary metals.....	627	1.6	1,329	2.3	212.0
Paper & allied products.....	243	.6	554	.9	228.0
Other commodity producing industries.....	4,443	11.6	5,317	9.1	119.7
All noncommodity producing industries, total.....	22,409	58.4	36,083	61.7	161.0
<u>Delaware River Service Area:</u>					
All nonagricultural industries, total.....	7,106	100.0	8,932	100.0	125.7
All nonagricultural commodity producing industries.....	2,883	40.6	3,502	39.2	121.5
Manufacturing, total.....	2,197	30.9	2,907	32.5	132.3
Food & kindred products.....	135	1.9	215	2.4	159.3
Chemicals & allied products..	102	1.4	190	2.1	186.3
Petroleum & coal products....	--	--	65	.7	--
Primary metals.....	67	.9	146	1.6	217.9
Paper & allied products.....	38	.5	80	.9	210.5
Other commodity producing industries.....	686	9.7	595	6.7	86.7
All noncommodity producing industries, total.....	4,223	59.4	5,430	60.8	128.6

Table 47

## DELAWARE RIVER SERVICE AREA

## EMPLOYMENT PATTERNS BY SUB-REGIONS, 1930 AND 1955

(Percent of total employment in each area)

	<u>All industries</u>	<u>Agri- culture</u>	<u>Nonagricultural commodity produc- ing industries</u>		<u>All non- commodity producing industries</u>
			<u>Total</u>	<u>Manufac- turing</u>	
Delaware River Service Area:					
1930	100.0	2.8	39.4	30.1	57.8
1955	100.0	1.6	38.6	32.0	59.8
New York City Metropolitan					
1930	100.0	1.0	37.1	28.3	61.9
1955	100.0	0.5	35.6	30.0	63.9
New York City Supplement					
1930	100.0	8.2	39.9	31.8	51.9
1955	100.0	3.8	43.0	34.1	53.1
Bethlehem-Allentown-Reading					
1930	100.0	8.3	51.5	43.2	40.5
1955	100.0	4.8	55.2	47.9	40.3
Trenton Metropolitan					
1930	100.0	3.9	45.4	36.4	50.7
1955	100.0	1.8	41.8	33.6	56.4
Philadelphia Metropolitan					
1930	100.0	3.3	44.4	35.7	52.3
1955	100.0	1.6	43.7	36.2	54.8
Wilmington Metropolitan					
1930	100.0	9.5	44.1	35.7	46.4
1955	100.0	3.7	46.3	37.5	50.0
Upper Basin					
1930	100.0	14.4	48.0	19.3	37.6
1955	100.0	9.8	44.4	31.8	45.8
Southern Basin and Coastal					
1930	100.0	17.1	28.6	17.1	54.3
1955	100.0	10.9	32.1	20.2	57.0

Table 48

DELAWARE RIVER SERVICE AREA  
EMPLOYMENT PATTERN, APRIL 1930  
(Thousands)

	United States total	Delaware River Service Area, total	New York City Met.	New York City Supple- ment	Bethlehem- Allentown- Reading
All industries.....	48,833	7,309	4,859	318	264
Commodity producing industries, total.....	26,423	3,086	1,852	153	158
Manufacturing, total.....	11,498	2,197	1,373	101	114
Food & kindred products.....	907	135	87	4	5
Chemicals & allied products...	621	102	70	4	3
Petroleum & coal products...	--	--	--	--	--
Primary metal industries....	627	67	5	2	16
Paper & allied products.....	243	38	22	1	2
Noncommodity producing industries, total.....	22,409	4,223	3,007	165	107

	Trenton Met.	Phila- delphia Met.	Wil- mington Met.	Upper Basin	Southern Basin & Coastal
All industries.....	77	1,365	84	202	140
Commodity producing industries, total.....	38	651	45	126	64
Manufacturing, total.....	28	487	30	39	24
Food & kindred products.....	1	30	1	3	3
Chemicals & allied products...	--	15	6	2	1
Petroleum & coal products...	--	--	--	--	--
Primary metal industries....	--	41	2	1	--
Paper & allied products.....	--	11	2	1	--
Noncommodity producing industries, total.....	38	714	39	76	76



Table 49

DELAWARE RIVER SERVICE AREA  
EMPLOYMENT PATTERN, APRIL 1940  
(Thousands)

	United States total	Delaware River Service Area, total	New York City Met.	New York City Supple- ment	Bethlehem- Allentown- Reading
All industries.....	45,166	6,613	4,421	322	254
Commodity producing industries, total.....	22,018	2,567	1,533	146	154
Manufacturing, total.....	10,573	2,044	1,278	101	122
Food & kindred products.....	1,094	158	103	5	7
Chemicals & allied products.....	440	118	77	4	2
Petroleum & coal products....	201	43	26	1	--
Primary metal industries.....	634	67	16	1	23
Paper & allied products.....	328	53	32	1	3
Noncommodity producing industries, total.....	23,149	4,045	2,889	176	101
	Trenton Met.	Phila- delphia Met.	Wil- mington Met.	Upper Basin	Southern Basin & Coastal
All industries.....	76	1,165	86	165	123
Commodity producing industries, total.....	35	515	42	90	53
Manufacturing, total.....	29	425	31	31	23
Food & kindred products.....	1	35	1	3	3
Chemicals & allied products.....	--	19	13	2	1
Petroleum & coal products....	--	15	1	--	--
Primary metal industries.....	1	22	1	3	--
Paper & allied products.....	--	16	--	1	--
Noncommodity producing industries, total.....	41	649	44	75	70

Table 50

DELAWARE RIVER SERVICE AREA  
EMPLOYMENT PATTERN, APRIL 1950  
(Thousands)

	United States total	Delaware River Service Area, total	New York City Met.	New York City Supplement	Bethlehem-Allentown-Reading
All industries.....	57,222	8,102	5,338	418	312
Commodity producing industries, total.....	25,950	3,232	1,937	186	185
Manufacturing, total.....	14,576	2,596	1,623	136	149
Food & kindred products.....	1,399	189	119	6	8
Chemicals & allied products.....	659	166	107	6	4
Petroleum & coal products....	287	58	33	1	—
Primary metal industries.....	1,167	119	39	8	30
Paper & allied products.....	467	72	44	1	5
Noncommodity producing industries, total.....	31,272	4,870	3,400	233	128

	Tranton Met.	Phila-delphia Met.	Wil-mington Met.	Upper Basin	Southern Basin & Coastal
All industries.....	98	1,467	106	201	161
Commodity producing industries, total.....	45	645	52	111	70
Manufacturing, total.....	38	527	39	50	34
Food & kindred products.....	1	43	2	3	6
Chemicals & allied products.....	1	27	17	2	2
Petroleum & coal products....	—	23	1	—	—
Primary metal industries.....	3	33	2	5	—
Paper & allied products.....	1	19	1	1	—
Noncommodity producing industries, total.....	53	822	54	90	91

Table 51

## DELAWARE RIVER SERVICE AREA

## EMPLOYMENT PATTERN, 1955

(Thousands)

	United States total	Delaware River Service Area, total	New York City Met.	New York City Supple- ment	Bethlehem- Allentown- Reading
All industries.....	65,250	9,073	5,897	495	357
Commodity producing industries, total.....	29,168	3,643	2,128	232	213
Manufacturing, total.....	17,121	2,907	1,768	169	171
Food & kindred products.....	1,531	215	129	8	10
Chemicals & allied products.....	804	190	117	7	5
Petroleum & coal products....	315	65	--	--	--
Primary metal industries....	1,329	146	49	9	32
Paper & allied products.....	554	80	52	2	5
Noncommodity producing industries, total.....	36,083	5,430	3,769	263	144

	Trenton Met.	Phila- delphia Met.	Wil- mington Met.	Upper Basin	Southern Basin & Coastal
All industries.....	110	1,671	136	214	193
Commodity producing industries, total.....	47	757	68	116	83
Manufacturing, total.....	37	604	51	68	39
Food & kindred products.....	2	52	2	4	8
Chemicals & allied products.....	1	33	21	3	3
Petroleum & coal products....	--	--	--	--	--
Primary metal industries....	3	47	2	3	1
Paper & allied products.....	1	18	1	1	--
Noncommodity producing industries, total.....	62	915	69	98	110

Table 52

DELAWARE RIVER SERVICE AREA  
POPULATION GROWTH RATES BY SUB-REGIONS, 1870-1956

	Delaware River Service Area, total	New York City Met.	New York City Supple- ment	Bethlehem- Allentown- Reading	Trenton Met.
Average Annual Percent Growth Per Period					
1870-80	1.98	2.53	.60	1.21	2.35
1880-90	2.25	2.78	1.86	1.03	3.27
1890-1900	2.46	3.22	1.29	1.40	1.74
1900-10	2.72	3.38	1.81	1.76	2.86
1910-20	1.73	1.88	1.50	1.37	2.42
1920-30	2.11	2.49	1.91	1.27	1.57
1930-40	.58	.72	.90	.26	.52
1940-50	1.12	1.03	1.93	.87	1.57
1950-55	1.73	1.41	3.30	1.64	1.68
1950-56	1.67	1.42	2.81	1.38	1.60

	Phila- delphia Met.	Wil- mington Met.	Upper Basin	Southern Basin & Coastal
Average Annual Percent Growth Per Period				
1870-80	2.04	1.60	.53	1.28
1880-90	2.00	1.81	.69	1.43
1890-1900	1.81	1.02	.66	1.76
1900-10	1.83	1.06	1.02	1.83
1910-20	1.81	2.12	-.08	.59
1920-30	1.46	.68	.60	2.49
1930-40	.20	1.15	.10	.47
1940-50	1.38	1.90	-.22	1.66
1950-55	2.34	4.19	.37	2.53
1950-56	2.09	4.35	.31	2.99



Table 53

## DELAWARE RIVER SERVICE AREA

POPULATION - RELATIVE DISTRIBUTION BY SUB-REGIONS, 1870-1956

Delaware River Service Area, total	New York City Met.	New York City Supple- ment	Bethlehem- Allentown- Reading	Trenton Met.
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## Areas as a Percentage of Delaware River Service Area Totals

1870	100.0	48.3	7.1	6.6	1.0
1880	100.0	51.0	6.2	6.1	1.1
1890	100.0	53.7	6.0	5.4	1.2
1900	100.0	57.8	5.3	4.9	1.1
1910	100.0	61.7	4.9	4.4	1.1
1920	100.0	62.6	4.8	4.3	1.2
1930	100.0	65.0	4.7	3.9	1.1
1940	100.0	65.8	4.8	3.8	1.1
1950	100.0	65.2	5.2	3.7	1.2
1955	100.0	64.2	5.7	3.7	1.2
1956	100.0	64.2	5.6	3.7	1.2

Phila- delphia Met.	Wil- mington Met.	Upper Basin	Southern Basin & Coastal
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## Areas as a Percentage of Delaware River Service Area Totals

1870	23.5	1.9	8.6	2.9
1880	23.6	1.9	7.5	2.7
1890	23.1	1.8	6.4	2.5
1900	21.7	1.5	5.4	2.4
1910	19.9	1.3	4.5	2.2
1920	20.0	1.4	3.8	1.9
1930	18.8	1.2	3.3	2.0
1940	18.1	1.3	3.1	2.0
1950	18.5	1.4	2.7	2.1
1955	19.1	1.5	2.6	2.2
1956	19.0	1.6	2.5	2.3

CHARACTERISTICS OF FOREIGN TRADE

Through

DELAWARE RIVER PORTS

The international trade going through the Delaware River ports does not appear to be merely a function of the economic growth of the area adjacent to the river. The combined tonnage of imports and exports has expanded over the past two decades at a considerably higher rate than the tonnage of all U. S. oceanborne foreign trade.

A closer look at the composition of the cargo movements through the Delaware River suggests that the rise in the volume of imports was due to basic changes in the relation between the availability of, and the requirements for, basic resource materials in a major part of the United States.

The growth in the tonnage imported has been concentrated in relatively few commodities. Crude petroleum accounted for about 65 percent of the rise, iron ore for about 30 percent. Other commodities, imports of which increased significantly since the pre-war period, include fuel oils, metallic ores and concentrates other than iron ore, gypsum and other non-metallic minerals. Imports of sugar and molasses which accounted for about one-fourth

of the tonnage imported in 1935 fell off tonnage-wise, and general dry cargo imports remained practically unchanged.

On the export side, the rise in coal and grain movements nearly equaled the total increase in the volume of exports. General cargo exports also rose, but export shipments of petroleum and products declined.

The significance of the Delaware River ports in international trade is more in the case of imports than of exports. In 1935, import tonnage was about 3 times as high as export tonnage, and in 1956 about  $6\frac{1}{2}$  times as high.

The tonnage of trade, both exports and imports, cannot be estimated in the same manner as the value since it is dominated by relatively few, and generally low-valued, commodities. Nearly half of the total U. S. import tonnage in 1956 consisted of crude petroleum and fuel oil which accounted for about one-eighth of the value of oceanborne imports. Iron ore and bauxite accounted for about 20 percent of the import tonnage but only for less than 3 percent of the import value.

Export tonnage is also strongly influenced by relatively few commodities, such as coal, wheat, fuel oil, and iron and steel scrap.

Mainly because of the large increase in imports of petroleum and iron ore, the tonnage of imports increased from the prewar period much more than the value after adjustment for prices. The same, but to a lesser extent, is true also of exports.

If the tonnage of total U. S. trade had been extrapolated from the prewar to the postwar period on the basis of a constant relationship between tonnage and a price-adjusted value, the tonnage would have been greatly underestimated. This indicates the margin of errors which may be associated with projections of foreign trade tonnage based on extrapolation of historic data.

The margin of error would have been even greater if the foreign trade tonnage moving through the Delaware River ports had been extrapolated on the basis of overall measurements and the composition of the trade in the prewar period.

#### Relation of Markets and Sources of Supply

The growth of imports of crude petroleum and iron ore through the Delaware River is, of course, closely related to shifts in the sources of supplies of these materials. As U. S. demand for them grew faster during the postwar period than domestic supplies, and as the gradual exhaustion of the best domestic sources raised the cost of domestic production, imports increased. The sources of production available abroad, Venezuela and the Middle East for crude oil, and Venezuela and several other Latin American countries, Africa, and Labrador for iron ore, favored the establishment of processing industries along the eastern seaboard of the United States. The choice of the Delaware River Basin including the Port of New York area for



the location of petroleum refining and distributing facilities was no doubt influenced by the proximity to the large Middle Atlantic markets.

Thus the development both of imports and of the size of the petroleum industry in that area was determined by the location of the markets as well as by the change in the sources of raw materials required to meet the domestic demand.

In the longer run the portion of domestic demand supplied through imports may grow more rapidly than the total domestic petroleum demand — as has been the case during the postwar period. In that case the importance of the Delaware River area as a port of entry of the crude product and a point of refining and distribution will also grow relatively more than total petroleum demand in the United States or in the Middle Atlantic region because the marketing area of that region would expand westward.

The rise in the imports of iron ore is only in part associated with the development of steel production in the area. The latest information available indicates that about two-thirds of the volume imported in 1956 through Delaware River ports was unloaded at the Port of Philadelphia, the remainder in other places in the area, including Morrisville, Pennsylvania. A large part of the imports through Philadelphia are transshipped to inland points such as Pittsburgh. This applies particularly to iron ore obtained from the new developments along the Quebec-

Labrador border. These operations flow from investments abroad by U. S. steel companies in the Pittsburgh area. The iron ore used in the Morrisville plant originates mostly in Venezuela where private companies have large investments in mining facilities.

The future of iron ore traffic through the Delaware River will thus depend upon several developments which would be difficult to evaluate at this time.

1. The extent to which expansion of steel output will depend upon ores imported from Africa and Latin America. (In both continents new developments are envisaged.) The most advantageous location of new steel mills using such ores would be along the Atlantic within easy reach of the Appalachian coal deposits. The Delaware River area is certainly within the radius of the best locations, but other areas likewise afford attractive locations.

2. Potential traffic through the Delaware River would be affected competitively by the development underway of the St. Lawrence waterway, but this factor has not been evaluated in connection with this particular report.

3. The expansion in traffic through the Delaware River would be affected to the extent that new steel producing capacity might be based on Canadian ores shipped through the Great Lakes or the use of lower grade U. S. ores from the Lake Superior region.

### Short-run Influences on Exports

On the export side, the volume of traffic for the short run depends mainly on shipments of grain and coal.

For neither commodity are the Delaware River ports major points of shipments. In 1955 coal shipments were about 3 percent of total waterborne U. S. coal exports and grain shipments not quite 6 percent. In 1956, however, the share of the Delaware River ports increased somewhat. Consequently, the volume of traffic in these commodities not only depends upon the size of the foreign trade but also on its distribution among several competing ports. The demand for U. S. coal by European countries has been estimated by the OEEC to decline in the near future or at least not to expand, partly as a result of the increased use of other sources of energy, and partly by increasing the efficiency in the use of coal. Long-run prospects for continued high or growing exports of grains from the United States appear to be more favorable as the population throughout the world continues to rise.

In grain exports, however, the opening of the St. Lawrence may well affect the share going through Delaware River ports, though it may be expected that the combined totals will increase.

The future of foreign trade traffic through the Delaware River cannot be estimated on the basis of recent experiences. Continuous shifts in the relative supply position of the United States and other countries for raw materials may within a

relatively short time add new commodities to those now imported and exported by that region. Some of these commodity movements may be associated with the establishment of major processing industries which may be new to that area.



Table 54

## IMPORTS AND EXPORTS OF PRINCIPAL PRODUCTS THROUGH THE

DELAWARE RIVER, TRENTON, NEW JERSEY TO THE SEA

	(Thousand short tons)					
	1935	1939	1947	1948	1953	1956
<u>Imports</u>						
Crude petroleum.....	1,565	1,609	6,745	8,871	19,774	24,520
Fuel oils.....	26	48	759	341	739	677
Iron ore.....	18	16	53	563	1,259	10,604
Other metallic ores, concentrates, etc....	173	287	336	769	851	886
Sugar.....	615	561	750	534	360	321
Molasses.....	524	573	335	354	593	499
Gypsum, clays and earths, other non-metallic minerals and manufactures.....	331	575	373	509	665	857
All other imports (mostly general cargo).....	1,159	1,117	1,442	771	1,309	1,334
Total - All commodities.....	4,411	4,786	10,793	12,712	25,550	39,698
% crude petroleum and iron ore of total.....	36	34	63	74	82	88
<u>Exports</u>						
Coal.....	77	116	5,492	1,898	173	3,397
Grain.....	---	84	732	564	624	1,123
Petroleum and products.....	891	587	1,244	701	265	404
All other exports (mostly general cargo).....	452	869	1,481	732	634	1,148
Total - All commodities.....	1,420	1,656	8,949	3,895	1,696	6,072
% coal and grain of total.....	5	12	69	63	47	74

Table 55

## OCEANBORNE IMPORTS AND EXPORTS OF THE UNITED STATES

## TOTAL AND ATLANTIC PORTS

(Thousand short tons)

	1935	1939	1947	1948	1953	1955	1956
Total imports of the United States.....	33,943	37,854	57,366	68,078	120,566	144,167	163,277
Crude petroleum and residual fuel oil....	8,512	9,475	24,498	28,784	56,791	66,910	75,613
Iron ore.....	1,649	2,677	3,751	5,488	10,156	20,976	26,309
Total imports through Atlantic ports.....	26,176	31,615	48,050	55,903	96,732	116,198	127,608
Total exports of the United States.....	33,923	57,711	103,755	65,404	63,780	95,404	126,446
Coal.....	717	1,721	47,040	21,504	14,025	32,808	40,867
Grain.....	1,120	2,869	8,064	6,832	11,036	13,505	19,341
Total exports through Atlantic ports.....	10,463	22,164	65,330	37,360	28,834	56,226	74,384

Table 56

IMPORTS AND EXPORTS THROUGH THE DELAWARE RIVER IN RELATION TO TOTAL  
UNITED STATES OCEANBORNE TRADE AND TRADE THROUGH ATLANTIC PORTS

	(Percent)					
	1935	1939	1947	1948	1953	1956
Total imports through the Delaware River in:						
% of total U. S. oceanborne imports.....	13.0	12.7	18.8	18.7	21.2	24.3
% of imports through Atlantic ports.....	16.9	15.1	22.5	22.7	26.4	31.1
Imports of Petroleum and products through the Delaware River in % of total U. S. oceanborne imports of petroleum and products.....	18.7	17.5	30.6	32.0	36.1	33.3
Imports of Iron ore through the Delaware River in % of total U. S. oceanborne imports of iron ore.....	1.1	.6	1.4	10.3	12.4	40.3
Total exports through the Delaware River in:						
% of total U. S. oceanborne exports.....	4.2	2.9	8.6	6.0	2.0	4.8
% of exports through Atlantic ports.....	13.6	7.5	13.7	10.4	5.9	8.2
Exports of Coal through the Delaware River in % of total U. S. oceanborne exports of coal....	10.7	6.7	11.7	8.8	1.2	6.9
Exports of Grains through the Delaware River in % of total U. S. oceanborne exports of grain...	--	2.9	9.1	8.3	5.7	5.8

## Chapter V

### SOURCES AND METHODS

#### used in PREPARING BASIC MEASURES

This is the first regional survey that the Office of Business Economics has made for an area representing a part of a State. Consequently, it involved the development of techniques and the assembly of data from a wide variety of sources which we have spelled out in this section. This has been done so that users may know how the measures were put together, and because we regard this as a useful guide to others who may wish to do similar studies of other regions.

This chapter describes the sources and methods underlying the economic measures used in this survey. They include personal income, population, and employment. The following explanatory notes describe both the historical series and the projections.

Major guides were developed for the Delaware Service Area and for the sub-regions which were delineated for purposes of this study. Data were prepared for the 49 counties in the Area, including those in the Delaware River Basin and the relatively nearby counties which are either present or potential users of the Delaware River waters. Availability of basic data required for our measurements was an important factor in the grouping of counties that was determined.



## PERSONAL INCOME ESTIMATES

Personal income, the most comprehensive measure of economic activity that can be prepared on a geographic basis, provides a yardstick for charting the past growth, and future potential, of the Delaware River Service Area. It is a gauge of both economic activity and purchasing power.

Official estimates of personal income on a less-than-national basis are limited to those prepared annually by the Office of Business Economics for the 48 States, the District of Columbia, and Hawaii. The first task in making the economic survey of the Delaware River Service Area, therefore, was to prepare estimates of personal income for the sub-regions which had been delineated. It may be noted that these notes describe the estimates through 1955. In updating the report in 1959 the personal income figures were extended to 1957. No changes were made in this section, however, as the methodology used for 1955 is directly applicable for 1957.

A large body of economic information on metropolitan areas, cities, counties, and other local areas is available from government and business sources. These data fall generally into one of two classes. They are part of the factual array collected in the periodic industrial and population censuses of the Federal Government; or, they are by-products of the administrative functions of some operating agency or organization -- governmental or private.

A major example of by-product type material is afforded by the tabulations made by State Unemployment Insurance (UI) agencies of wages and salaries disbursed in each county of a State by employers in industries covered by State UI laws. By-product data compiled by a private business organization are the statistical series maintained by various State associations of railroads. In most instances, these organizations have available, or can prepare, tabulations of payrolls disbursed to railroad employees county-by-county.

Although the quantity of data relevant to the measurement of personal income by counties is large, two serious deficiencies limit their usability for income estimation. Certain sizable gaps exist in data coverage. For example, information on county or other local-area distribution of income from dividends, interest, and rents is very sparse. Similarly, little direct information on the net income of self-employed persons is available at the county level.

Secondly, and apart from gaps in coverage, such information on economic activities as is recorded on a county basis is not done within the framework of a coordinated statistical program designed for income measurement. For the most part, reported statistical information is not directly or wholly suitable for this purpose and must be processed to adjust for differences in definition and scope. Local-area income measurement therefore becomes a two-fold task: Assembling data from a multiplicity of sources and then

adapting them, through estimation, in a step-by-step buildup of aggregate income from component flows.

#### MAIN STATISTICAL APPROACH

Several main aspects of the statistical approach used may be noted.

Relatively little use is made of income reports of individuals. Instead, reliance is placed on records of business and government which show disbursements made to persons. This approach, it is felt, makes for significantly greater accuracy.

The local-area estimates prepared in this study are tied directly to the Department of Commerce official estimates of personal income by States. This is, the State total for each income component as taken from the official State income series is broken down or allocated to the various counties of the State in accordance with each county's proportionate share of some related series available on a county basis. This allocation procedure makes for greater accuracy in the county estimates because most components of personal income can be estimated more accurately for States than for smaller geographic areas. Also, it permits the utilization of numerous related series of data which do not "match" the basic series to be allocated in some respect such as definition or coverage. Estimates based on direct, comprehensive data are generally more accurate than those based on indirect allocators and the direct approach has been used wherever possible. It should not be over-

looked, however, that in numerous instances the State total of a component to be allocated has been derived from the same basic data sources as the allocating series. In such cases, there is no essential difference in accuracy between the State and local-area estimates.

The allocation procedure is carried out in detail. Separate estimates are made for each of more than 100 components of income and total personal income is derived by summing the individual series. This detailed approach accomplishes three main purposes. It permits the maximum utilization of all available sources of information and thus minimizes errors that would stem from the estimation of broad components on the basis of data differing in scope or internal composition. Secondly, the detailed approach brings into play the potent factor of "offsetting errors". The tendency for errors in underlying components to compensate in the totals is a phenomenon observed repeatedly in the field of income estimation when a detailed, careful statistical procedure is followed.

Finally, a concomitant result of the use of a detailed allocation method is that it yields a considerable quantity of analytically useful information with regard to sources of income in local areas. It is recognized, of course, that a substantial amount of the industrial detail that stems from use of the allocation procedure is not sufficiently reliable to warrant separate analysis. Rather, this detail should be viewed as worksheet entries in the buildup of larger



and more reliable income components. Nevertheless, a detailed statistical approach has the merit of providing more usable analytical information than would any other feasible approach.

Closely related to the aspect of industrial detail is that of geographic detail. Estimates of the various income components were made on a county basis to the extent possible. Figures for the separate counties were then grouped into the eight sub-regions chosen for presentation in the survey. Although counties formed the basic "building blocks", estimates are not shown for these units.

The absence of county figures stems from two factors. First, for a number of components, the most satisfactory data on which to base an estimate were available for metropolitan areas or for groups of counties. In such instances extension of geographic detail to the county level was sacrificed in favor of greater accuracy in the over-all estimates. In elaboration of this point, it may be noted that whereas certain of the detailed income estimates must be classed as statistically unreliable on a county basis, they appear to rate as tolerably satisfactory when the county figures are grouped into area totals.

Secondly, income estimates for individual counties are not shown because of the lack of requisite data for making adjustments to take account of commuting of workers across county lines. Certain income components (wages and salaries, in particular) are measured at the point of disbursement (place of work), while others (property income, for example) are estimated on a residence basis. Where

workers reside in one county and work in another, personal income as estimated for those counties is partly on a "where-received" basis and partly on a "where-earned" concept. Data suitable to convert personal income wholly to either of the two definitions are lacking. Accordingly, the commuter problem is "solved" by grouping counties into geographic areas so that commuting across area lines is at a minimum. This solution precludes the publishing of meaningful estimates for individual counties.

Before turning to a description of sources and methods of estimation, the question of reliability may be noted. It has been made evident that the figures on personal income are estimates, and therefore subject to error. Some of the components entering into the total are highly accurate while others are quite weak. In neither case can a mathematical measure of reliability be attached to the figures.

The fact that the reliability of the county income estimates is not subject to quantitative evaluation stems from a number of factors. The basic data entering the estimates vary in quality or accuracy; they differ in suitability for use in income estimation; and the characteristics of a given series of data may change over time. Also operating against the calculation of over-all measures of reliability is the variety of statistical techniques and assumptions that must be used in processing and adjusting the basic data for income measurement.

In view of these conditions, it is apparent that local-area income estimates must be evaluated in terms of their adjudged adequacy for the particular purpose at hand.

#### DERIVATION OF THE ESTIMATES

The following summary of sources and methods underlying each of the main elements of personal income has a twofold purpose: It provides a means of assessing reliability; and, it serves to acquaint users with the specific content of the personal income estimates.

A more comprehensive description of the details of personal income may be found in "Personal Income by States Since 1929", a supplement to the Survey of Current Business, monthly magazine of the Department of Commerce.<sup>5/</sup> This State Income bulletin contains a full description of the personal income series in terms of definitions and of sources of data and methods of estimation. The income figures assembled here for the sub-regions of the Delaware accord exactly with the State estimates in concept and definition. To the extent possible, the sources of data and estimating techniques used in allocating national totals to the States were used to further apportion State totals to the counties. Hence, the State Income bulletin will provide a basic reference for those wishing a fuller description of personal income and its derivation than that set forth here.

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<sup>5/</sup> Copies of the supplement are available from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., or from any Department of Commerce Field Office at \$1.50 each.

BEST AVAILABLE COPY

## WAGES AND SALARIES

Wage and salary disbursements account for 70 percent of all personal income in the Delaware River Service Area. Estimates of this segment are more complete and reliable than those for any other major type of income. Because of their sizable weight in the total income flow, they impart a large measure of reliability to the over-all estimates of personal income.

For the years since 1950, estimates of wages and salaries have been prepared for about 40 individual industries. For 1940 and 1929, the number for which separate estimates were made was reduced to 15.

In the following presentation derivation of the payroll figures is discussed in two parts. The first includes industries covered by State unemployment insurance (UI) programs. The second group consists of industries not covered by UI and for which other data sources -- some direct, others indirect -- were relied upon.

### Social Security Coverage

The most important source of statistical information on payrolls for the period of the past two decades has been the data collected under State UI programs. Except as subsequently noted, each State of the Delaware Basin furnished county tabulations by detailed industries (approximately 75) of wage and salary



disbursements made by firms coming under its UI laws. These data formed the basis of the 1940, 1950, and 1955 payroll estimates for industries making up 80 percent of all wages and salaries paid in the Delaware Basin.

The reporting systems that have developed under the State UI laws are comprehensive and employ regular, compulsory reporting by employers. The accuracy and completeness of reported data is enhanced further by the fact that each "covered" firm is required to maintain a list of employees and their wages individually. Because of the nature of the reporting systems, then, the UI data approach the ideal for income estimation, and county wage and salary disbursements in industries based on these data are considered quite reliable.

Despite the over-all adequacy that characterize UI tabulations generally, the figures as reported by the individual States do not constitute a measure of total payrolls. Instead, estimation is required to fill data gaps. In New York, New Jersey, and Connecticut, establishments with less than 4 employees<sup>6/</sup> are exempt from mandatory UI coverage. Satisfactory estimates of payrolls in these relatively small firms were derived from special tabulations of the Bureau of Old-Age and Survivors Insurance (BOASI) and added to the UI figures.

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<sup>6/</sup> Beginning in 1956, the UI programs in both New York and Connecticut cover establishments with three or more employees.

Unemployment insurance covers firms without regard to size in both Delaware and Pennsylvania. However, more serious limitations of a different nature marked UI information in these two States. In Pennsylvania, county tabulations were available for only one quarter of the year. Accordingly, the Pennsylvania State total of payrolls in each industry covered by the UI program was distributed to counties in 1955 in proportion to UI-reported payrolls in the first quarters of 1955 and 1956 combined. For 1950, UI data for the first quarter of 1949 were used as an allocator, while for 1940 the UI distributor related to the third quarter of that year.

In Delaware, county tabulations of UI data were not furnished for detailed industries but only for seven broad industry divisions and the over-all total. Moreover, no UI data were obtained for years prior to 1950.

In addition to these gaps in social security coverage or tabulations, numerous minor deficiencies exist in all States. As an example, there is the problem of classifying both geographically (by counties) and industrially payrolls left unallocated by UI. Again, allowance must be made for certain segments of various industries which are outside the scope of the State UI laws. These include federally chartered credit unions, Federal Reserve Banks, national banks and State banks that are members of the Federal Reserve System in New Jersey, electric railways, carrier affiliates in the industry services allied to transportation, insurance solicitors on commission

basis, and employees' tips. In some instances, payrolls of these industrial segments could be estimated by counties quite readily. In others the task was difficult and the results less satisfactory.

In the absence of UI data, a special procedure was necessary to prepare the 1940 estimates for Delaware. Accordingly, extrapolation by one of three general types was used to extend the 1950 UI-based figures back a decade. County estimates of payrolls in mining, construction, finance, insurance, and real estate were moved from 1950 to 1940 by changes in special aggregates constructed for this particular purpose. These extrapolators were derived for 1940 and 1950 as the product of the number in the labor force in each industry and average wages in retail and wholesale trade combined. Numbers of workers in the labor force were taken from the 1940 and 1950 Census of Population. Average wages by counties were computed for 1950 from UI-reported payrolls and employment in trade. These county averages were extended to 1940 by relative changes in average wages in trade between 1948 and 1939 as calculated from the Census of Business for each of those years.

County payrolls in 1940 in the transportation, communication, and public utilities industries (excluding railroad and water transportation) were derived in the same manner as for mining, construction, etc., with one minor variation. Average wages used in the extrapolation reflected those in trade and manufacturing combined instead of in trade alone.

County estimates of average wages and salaries in Delaware manufactures in 1950 (based on UI) were extended to 1947 by changes in factory payrolls as shown in County Business Patterns for 1947 and 1951. The resulting county figures for 1947 were then extrapolated to 1940 by total manufacturing payrolls as shown in the 1939 and 1947 Census of Manufactures.

A procedure similar to the above was followed for trade and for selected service industries except that the 1950 figures were moved first to 1948 by data from County Business Patterns and then to 1940 by figures reported in the 1939 and 1948 Census of Business.

In the absence of State UI data prior to 1938, special methods of estimation were required to extend "covered" wages and salaries from 1940 to 1929. These methods are set forth below in summary fashion.

For wholesale and retail trade and for manufacturing, county estimates of wages and salaries in 1940 were extrapolated to 1929 by changes in payroll disbursements reported in the 1929 and 1939 censuses covering these industrial sectors. The manufacturing data required two types of adjustments. Some estimation was necessary to obtain figures for certain of the less industrialized counties. In addition, only selected components of factory payrolls were used in the extrapolator as there is some question regarding comparability of data reported by the Census of Manufactures for 1939 with those reported for earlier years. This stems from the fact that the 1939 census was the first to call for information relating to all



employees in manufacturing establishments, including those engaged wholly or chiefly in distribution, construction, and other nonmanufacturing activities. As the extent to which such employees were covered in earlier censuses cannot be ascertained, components including wages and salaries paid them were excluded from the extrapolating series in both 1929 and 1939.

The availability of census data for trade and manufacturing on a county basis in 1929 and 1939 gives a solid statistical basis to the county estimates of "covered" payrolls in 1929. Together wages and salaries in trade and manufacturing account for about two-thirds of all "covered" payrolls and about one-half of all wage and salary disbursements in the Delaware Basin in 1929.

County payroll figures in 1940 for construction, transportation (excluding water and railroad), and the "covered" service industries were extended to 1929 by the product of persons in the labor force in the corresponding industry and average wages. Numbers of persons were obtained from the 1930 and 1940 Census of Population. Average earnings refer to the manufacturing and trade industries and were computed from the industrial censuses of 1939 and 1929. This group of industries comprised approximately one-fourth of "covered" payrolls in the Delaware Basin in 1929.

The final two "covered" industries are mining, and finance, insurance, and real estate. The 1940 estimates for these were moved

to 1929 by county changes in the total number of persons engaged in these industries in 1930 and 1940 as reported in the censuses of population for those years.

#### Noncovered Industries

County estimates of wages and salaries are prepared for each of 12 industries, or types of employment, not covered by UI data. These include farms; Federal, State, and local governments; railroads; private households; professional and related services (including medical and other health services, nonprofit membership organizations, n.e.c., and educational services, n.e.c.); water transportation; agricultural services; and forestry and fisheries. The formulation of estimates for each of these industries is covered in the following sections. The only generalization with regard to reliability that can be applied to the "noncovered" group as a whole is that payroll estimates for this group are less accurate than those for "covered" industries. Exceptions to even this broad statement will be noted below.

Government. Benchmark estimates of government wage and salary disbursements in each Delaware Basin county in 1950 were prepared from data in the 1950 Census of Population. A county allocator for each of the five States in the Basin was prepared as follows. Preliminary estimates of total government payroll disbursements in the State and each of its standard metropolitan areas (SMAs) were computed as the product of number of employees and estimated average earnings. Data on number of employees were reported for each State,

county, and SMA by the census. Average earnings in 1949 (assumed to be the same in relative terms in 1950) for the State and each SMA were derived through calculation of arithmetic means from census data showing the distribution of government employees by total-income size classes. Such income distributions were not available for counties. Accordingly, the combined total for all counties not part of an SMA was derived by subtraction of the estimated SMA figures from the State total. This residual was allocated among counties in accordance with the number of government workers in each county as reported in the census.

The estimates derived in the foregoing manner for 1950 are considered to be of a high order of reliability. This judgment is based on the fact that nearly 90 percent of total government payrolls in the Delaware area in 1950 was based on reported income data while only about 10 percent rested on a distribution of a residual based on numbers of government workers.

The 1950 figures were extended to 1955 and to 1929 and 1940 by means of a specially constructed extrapolator. This series represents the piecing together of information from numerous and diverse sources. County distributions of wage and salary disbursements were derived for (1) Federal Government agencies, (2) State government agencies, (3) counties, (4) cities, and (5) special districts (such as school, sewage, or transportation districts). An indication of the reliability of the government payroll component may be obtained from the

fact that since 1950 from one-half to two-thirds of the total extrapolating series is based on reported payroll data in each State except New York, where the percentage is much higher. In 1940 the percentage varies between one-third and one-half; in 1929 there is a further reduction in the percentage directly reported.

The Federal segment of the extrapolating series for government payrolls incorporates the following direct data. A county distribution of Federal civilian wages and salaries and employment in the first quarter of 1956 became available with the extension of UI coverage to Federal workers. The 1956 payroll distribution was used to allocate State payrolls in 1955. These, in turn, were extended to 1950 by changes in Federal civilian employment. As noted, the number of workers in 1955 (actually 1956) were obtained from UI. Employment in 1950 was taken from a report on Federal Civilian Employment made by the Joint Committee on Reduction of Nonessential Federal Expenditures (Byrd Committee) to the Congress of the United States in 1950.

For 1940 and 1929, distributions of Federal postal employees were obtained from the decennial censuses of 1930 and 1940 and used to allocate State totals of Post Office payrolls. In 1929 postal payroll disbursements accounted for about two-thirds of all Federal pay; in 1940 they made up about two-fifths. Other segments of Federal civilian wages and salaries were extended from 1950 by changes in



population except that from 1950 to 1940 changes in wages and salaries paid civilian employees of the Defense Department were assumed to parallel changes in military strength.

Information on the county distribution of State government payrolls was limited. New York State reported the number of its employees located in each county in 1948, 1952, and 1955. For the other States, county distributions of State government employment in 1950 were derived by subtracting from total government employment as reported by the Census estimated employment of all governmental units other than those at the State level. The 1950 relative county distributions were altered in accordance with population changes between 1929, 1940, 1950, and 1955. Employment was used to allocate State totals of State government payrolls to counties.

County distributions of the combined payroll of counties, cities and special districts in 1955 were prepared from data in the 1957 Census of Governments. These distributions were extended back by the sum of the individual series described below.

Wages and salaries disbursed by county governments in 1929 and 1940 were based on payroll data from the 1932 and 1942 Census of Government. Estimates for 1950 and 1955 were derived by extrapolation of the 1940 figures forward by county changes in population.

Estimated payrolls of most cities in 1940, 1950, and 1955 were obtained from Census reports. Figures for the smallest cities were based on population. A series for 1929 was constructed from expenditure data contained in the 1932 Census of Governments.

Wages and salaries disbursed by special districts in 1950 were based chiefly on Census reports. For 1929, census-reported data on expenditures in 1932 were used. Figures for 1940 were derived by straightline interpolation between 1932 and 1940. Estimates for 1955 rested on an extrapolation of the 1950 figures by population.

Direct data on military pay disbursements are not available. Accordingly, county estimates were derived via military strength. In 1940, 1950, and 1955, military payrolls were allocated in two parts. State totals of cash pay and pay in kind (clothing and food) received directly by military personnel were distributed among counties in proportion to military strength by county of duty station. State totals of allotments of pay made by military personnel to their dependents were allocated to counties by the sum of civilian population and military strength with each weighted equally. Military pay in 1929 was distributed among counties in the same relative proportion as was estimated for 1940.

For 1940 it was necessary to allocate a special component of government payrolls which was not present in any other year covered by this study -- wages and salaries of persons on work-relief projects. These were distributed in accordance with the numbers of persons on work-relief in each county as reported by the 1940 Census of Population.

Agriculture. County wages and salaries in farming are measured by allocating the State totals of farm wages, as estimated annually

by the U. S. Department of Agriculture, according to the county distributions of cash farm wages reported in the quinquennial censuses of agriculture. The essential assumption here is that farm wages paid in kind are distributed among the counties of a State in proportion to cash wages. This assumption is of minor importance on two counts. First farm wages in kind account for only a small part of total farm wages. Second, farm wages are of below-average importance as a source of income in most sections of the highly industrialized and urban Delaware Basin.

Railroads. For the period since 1950 county estimates of railroad wages and salaries are regarded as quite reliable. This evaluation stems from the fact that the Associated Railroad Organization of each State except Pennsylvania furnished a county tabulation of wages and salaries paid railroad employees in their State. These figures, based on employer reports, are quite accurate.

In the absence of comparable information for Pennsylvania, county estimates of railroad wages and salaries were prepared in the manner similar to that described below for the professional and related services industry.

Also, the 1929 estimates for all States (and the 1940 figures for New Jersey) were derived by extending the 1940 estimates (1950 for New Jersey) back by relative changes in the number of persons employed in the railroad industry as reported in the 1929 and 1940 Census of Population.

Other private "noncovered" industries. For the remaining "noncovered" industries in the private sector, county estimates of wages and salaries are based largely on data from the decennial censuses of population. Because the sources of data and methods of estimation are common to all industries discussed in this section, the following description applies equally to the derivation of county payroll disbursements in private households, medical and other health services, nonprofit membership organizations, private educational services, water transportation, and forestry and fisheries.

For these industries, benchmark distributions of county payroll disbursements in 1950 were prepared. This consisted of allocating the Department of Commerce State total for individual industries among counties in accordance with the pattern exhibited by a preliminary estimate based on information in the 1950 Census of Population.

The preliminary series for each industry was prepared as the product of the number of private wage and salary workers in each county and estimates taken to reflect differentials in average earnings. The number of private employees in each State of the Delaware Basin and in each SMA of 100,000 or more population was tabulated directly from the 1950 Census of Population. For counties outside of SMAs, however, the employment figures in noncovered industries reflected the total labor force and not simply private employees. This county distribution was used to allocate the residual number of private wage earners calculated as the difference between the total number in the State and the number in SMAs.



Differentials in average earnings of persons in each "noncovered" industry were based on the 1950 Census of Population, through calculation of arithmetic means from data showing the distribution of persons by total-income size classes. Such averages could be computed only for the State as a whole and for each SMA of 250,000 or more population. An estimate of average earnings in the combined areas outside of SMAs was computed from the residual yielded by the subtraction of SMA figures from State totals. This residual average was used to represent each county lying outside an SMA.

In assessing the reliability of the 1950 benchmark estimates for noncovered industries, it should be noted that although a relatively indirect estimating technique was used for a number of counties, these were the less urbanized areas. Hence, in terms of either wages and salaries or number of private wage and salary workers, approximately nine-tenths of the Basin total was derived from directly reported data while only a relatively small proportion was estimated via the residual method.

The benchmark estimates of wages and salaries in the various noncovered industries in 1950 were extended to 1955 as follows. Private household payrolls were moved forward by changes in wages and salaries in personal services (a covered industry). Nonprofit membership organizations were extrapolated by UI data which covered a substantial portion of the industry. The remaining noncovered industries were extended by changes in population.

The 1950 county estimates were moved back to 1940, industry by industry, by an extrapolating series derived as the product of number of private wage and salary workers and average wages in some related "covered" industry. The derivation of the employment series for 1950 has been described; figures on employment in 1940 were obtained from the 1940 Census of Population in a directly comparable manner. Average wages in 1940 and 1950 were computed from the UI data for the industry selected as most relevant to the noncovered industry.

The 1940 figures for noncovered industries were extrapolated to 1929 by changes in the labor force of the appropriate industry as reported in the 1930 and 1940 Census of Population.

Miscellaneous industries. This last category of wages and salaries consists of two industries: Agricultural and similar service establishments and rest of the world. No data satisfactory for estimating their distributions by counties are available, but these industries are both minor industries quantitatively. Together they totaled only \$31 million in 1955, or one-tenth of 1 percent of all wage and salary disbursements in the Delaware Service Area.

Payrolls disbursed by agricultural services establishments were allocated among counties of the Delaware Area in proportion to the distribution of the net income of farm operators (described below).

The "rest of the world" component of wages and salaries represents payments received by United States residents in this country from international organizations (such as UN) and foreign governments. All of this item in the Delaware Basin is assigned to the New York City Metropolitan Area.

#### PROPRIETORS' INCOME

Proprietors' income measures the net business earnings of owners of unincorporated enterprises, consisting almost entirely of sole proprietorships and partnerships but including also producers' cooperatives and other numerically minor forms of noncorporate business. Farmers, independent professional practitioners (such as physicians, dentists, and lawyers), entrepreneurs in non-farm business, and others in a self-employment status are included in the scope of proprietors' income.

Measurement of this aggregate is considerably more difficult (and less accurate) than is that of wages and salaries. Contrary to the relative abundance of data in the area of payroll estimation, little direct information is available for proprietors' income. Such data as do exist are those contained in the 1950 Census of Population -- the first census to provide information along this line. These data serve as the principal base of a series that is believed to furnish a fairly good approximation of the comparative importance of noncorporate business income in the various county or sub-area totals. Estimates for years other than 1950 are based

largely on indirect information and hence their accuracy is significantly reduced.

Two broad segments of proprietors' income may be differentiated with respect to source material and methods used -- nonfarm proprietors' income and net farm income. The methodology used for each is summarized below.

#### Nonfarm Proprietors' Income

County estimates of nonfarm proprietors' income are derived in two steps. First, benchmark distributions measuring net income in all nonfarm industries combined were prepared for 1950 and for 1929. That for the later year was based on data collected in the 1950 Census of Population. The county distribution for 1929 was constructed from tabulations of Federal individual income tax returns filed in 1934. An extrapolating series by which the 1950 benchmark was extended to other years was prepared as the sum of separate estimates for each of 12 industries.

The 1950 benchmark. A county distribution of nonfarm proprietors' income in 1950 was obtained by allocating the total for each State in accordance with the distribution of county estimates constructed from the 1950 Census of Population.

This distributing series was derived by first computing aggregate income of all proprietors (farm and nonfarm) for the States, each standard metropolitan area, and all other counties combined --



the last computed simply as the difference between the State total and that of all SMAs taken together. Farm proprietors' income, estimated in a manner directly paralleling that for all proprietors' income, was deducted from the all-proprietors' series. This gave estimates of nonfarm proprietors' income for each State, each SMA, and for all non-SMA counties combined. The last total was broken down to individual counties in accordance with a relative distribution of the number of nonfarm proprietors (total self-employed minus farmers) in each county with numbers weighted by average wages and salaries of employees in the trade and service industries. Average payrolls were calculated from data in County Business Patterns, a joint publication of the Departments of Commerce and of Health, Education, and Welfare.

The procedure used to allocate the residual nonfarm proprietors' income to counties not in an SMA was used also to separate individual counties within an SMA when necessary.

For the Delaware service area as a whole, self-employment income of nonfarm proprietors living in SMAs, for which the estimates are most accurate, accounted for five-sixths of the total.

The 1929 benchmark. The county estimates of nonfarm entrepreneurial income for 1929 are weak. They were prepared by distributing State totals by adjusted county tabulations of proprietors' income reported by individuals on Federal income tax returns for 1934. Farm income included in these Internal Revenue tabulations

was deducted from the figures on an estimated basis in order to secure a nonfarm series and thereby eliminate a systematic bias in the estimates. The amount subtracted was estimated by distributing an estimated total for each State among counties according to the county estimates of net farm income (described below).

The extrapolating series. County estimates of the income of noncorporate nonfarm businesses in 1940 and 1955 were obtained by extending the 1930 benchmark by a special extrapolator derived as follows: For both 1940 and 1950, State totals of nonfarm proprietors' income for each of 12 industries were distributed to counties by the product of number of nonfarm self-employed persons and average wages.

The number of self-employed persons in each industry was tabulated directly from the 1950 and 1940 Census of Population for the State and for standard metropolitan areas (large cities in 1940). The number of self-employed in each industry for all counties outside of SMAs was computed as a residual. This area figure was allocated to the constituent counties by the relative distribution of the total labor force in the particular industry. Average wages in each industry were calculated for individual counties from UI wage and employment figures assembled in the preparation of estimates of covered payrolls, or from wage and employment data in County Business Patterns.

The 1950 extrapolating series was extended to 1955, industry by industry, on the basis of changes in aggregate wages and salaries in the corresponding industry. The resulting county estimates in each industry were then adjusted proportionately to equal the independently estimated State totals of proprietors' income in the industry. Total nonfarm proprietors' income in 1955 derived as the sum of the individual industry estimates and the comparable series for 1950 were then used to extend the 1950 benchmark estimates to 1955.

#### Farm Proprietors' Income

Local area estimates of the net income of farm proprietors are equal to (and derived statistically as) the gross income of farmers minus their total expenses of production.

As in the case of nonfarm proprietors' income, the central feature of the farm income estimating procedure is the allocation of independent State totals to counties by means of the most relevant information available. The principal source of local data on farm businesses is the quinquennial Censuses of Agriculture. It will be noted, that whereas local-area income estimates were prepared for 1929, 1940, 1950, and 1955 the data in the censuses generally related to 1929, 1939, 1949, and 1954. These slight differences in timing were ignored.

Despite the large amount of information collected in the various agricultural censuses, there are substantial gaps in data from the standpoint of estimating net farm income on a local-area basis. While the farm income estimates are thus subject to a wide margin of error, the effect of this on the personal income totals is slight throughout most of the Delaware area because of the comparative unimportance of agriculture as a source of income.

Gross farm income. This component covers the following separately estimated items: (1) Cash receipts from farm marketings of crops and livestock, (2) the value (positive or negative) of the change in inventories of crops and livestock, (3) payments to farmers under the Government's soil conservation and related programs, (4) the value of food and fuel produced and consumed on farms, and (5) the gross rental value of farm dwellings.

Farmers' cash receipts from marketings were distributed among counties according to the value of products reported by the Census of Agriculture as either sold or traded. In order to improve accuracy somewhat (by achieving the best weighting) and to obtain certain detail for use elsewhere in the estimating procedure, separate distributions for cash receipts were made for the various crops and livestock items to the extent possible.

No local-area data are available to measure the current value of the physical change in farmers' inventories over the year (included in net farm income in order to secure a measure of current



income, and not simply of net receipts). Accordingly, the State totals of the value of farm inventory change were allocated with the State totals of cash receipts from the corresponding crop or livestock item.

County distributions of food and fuel produced and consumed by farm families were taken directly from the Census of Agriculture for 1929 and 1939. The figures for the latter year were extended to 1950 by changes in the rural farm population as given in the 1940 and 1950 Census of Population. The 1950 relative distribution was held constant for 1955.

Payments made to farmers by the Federal Government for their participation in farm programs in 1940, 1950, and 1955 were obtained from the U. S. Department of Agriculture by counties. There was no such item in 1929.

The gross rental value of farm dwellings is an imputed item of income rather than a cash flow. It was estimated by distributing State totals on the basis of data measuring or reflecting the value of farm dwellings in each county. Figures for this item in 1929 were taken directly from the 1930 Census of Agriculture. A series reflecting county differentials in the value of farm dwellings in 1940 was estimated by multiplying the average value of owner-occupied farm homes and the total number of rural farm homes as reported for each county in the 1940 Census of Agriculture. This distribution was extended to 1950 in accordance with county-by-county changes in series calculated for both 1940 and 1950 as the

product of the number of farm dwelling units and the average value of owner-occupied rural nonfarm units in each of those years. In the absence of more relevant information the estimated distributions of gross rental value of farm dwellings in 1950 were used to allocate the 1955 State totals of this item. Since the expenses associated with farm dwellings are included with other farm expenses, only the net rental value of farm dwellings becomes an element of farm proprietors' income.

Farm production expenses. County estimates of the expense side of the farm income account are made for about 40 separate items. Nearly all county data used in the allocation of production expenses were obtained from the quinquennial censuses of agriculture. This information varies in terms of adequacy for use in county income estimation. Items such as hired labor and feed purchased are reported directly by the Census. Because their scope and content as defined by the Census is the same or closely similar to their definition as used in county income measurement, the county estimates resulting from their use are quite reliable. Unfortunately such expenses comprise a relatively small proportion of total production expenses.

Other items reported in the census are related to some explicit expense item in the income series. These include data on the value of farm buildings, machinery, and equipment. These value series are used to distribute the independently estimated State totals of

depreciation. Potential errors in a depreciation series based on total value as of a given date are large for obvious reasons.

Farm mortgage interest affords still another illustration of a situation comparable to that for depreciation. The interest item of farm cost is reported in the Census of Agriculture for individual counties. But, it covers only a selected group of farm operators and the data are available for only 2 years -- 1929 and 1939. Here the reliability of the county estimates depends on the degree to which the group of farm operators surveyed (farms operated by full owners owning no other farm land) is representative, county by county, of all farm operators paying mortgage interest.

The method of estimation underlying a final group of production expenses is illustrated by estimates of the costs of operating motor vehicles and net rents paid to landlords living on farms. For neither of these is any really relevant information available on which to construct county distributions. For both, a physical measure is the only factual underpinning of the estimate. In the case of motor vehicles some data on numbers of vehicles are available, while the net rents series rests on tabulations of the number of acres of farm land rented to and from others. County estimates of these and similar expense items must be regarded as subject to sizable error.

On balance, then, farm production expenses on a county basis are subject to larger error than the items of gross income. Further compounding this weakness is the fact that net farm income, as the statistical residual between gross income and production expenses, is subject to greater percentage error than the aggregates from which it is derived. As already observed, however, farm income in the Delaware basin is of generally insufficient magnitude to introduce significant error into the estimates.

#### PROPERTY INCOME

Property income consists of dividends, personal interest income, and rental income of persons. In 1955 these three together totaled \$7½ billion, or 15 percent of the personal income flow in the Delaware River Area. In 1929, they accounted for 30 percent.

Paucity of county data on property income flows constitutes a particularly acute problem in the field of local-area income estimation. This situation has required the use of indirect methods of estimation and has resulted in comparatively weak -- probably the weakest of the major components -- estimates of rents, dividends, and interest for small areas.

This generalization holds true for the estimates of property income made for the Delaware River Area with one important exception. The county estimates of dividends and interest in the New York State portions of the over-all area for 1950 and 1955 are based on special county tabulations of State income tax returns



prepared by the New York State Department of Taxation and Finance. Estimated dividends and increase in the New York areas together constitute 35 percent of all property income in the entire Delaware Area. Not only were the over-all estimates of property income in the Delaware Area improved directly by the availability of data from New York, but relationships involving these data were used in preparing estimates for other States.

County estimates of property income were derived as the sum of separate estimates for the following components: Dividends and private monetary interest combined, government interest, imputed rents, and other property income (consisting of monetary rents and imputed interest).

#### Dividends and Interest

Special tabulations of dividends and interest received by residents of the various counties in New York State in 1949 and 1954 were obtained as noted above. These figures were based on relatively small samples, and exhibited what appeared to be substantial sampling variability. Accordingly, the aggregates reported for each county were put on a per capita basis for both 1949 and 1954. The resulting per capitass were averaged and applied to population in 1950 and 1955. These preliminary county figures were used to distribute the independently estimated State totals of dividend and (private monetary) interest receipts in 1950 and 1955 to the individual counties of New York State.

County estimates of dividends and interest were prepared for other States of the area from the relationship between per capita income in New York counties. Per capita dividends and interest for New York were derived as explained above; per capita income was calculated from data in the 1950 Census of Population showing both total population and the distribution of families by size of total income in 1949 for each county. A regression curve was fitted to these county data and an estimating equation computed.<sup>7/</sup>

Per capita income was determined for the relevant counties of Connecticut, Pennsylvania, New Jersey, and Delaware on the basis of the 1950 Census of Population. From these county income figures and the regression equation, preliminary estimates of per capita dividends and interest were read off for the counties of the Delaware Area outside of New York State. The product of these per capitas and population in 1950 and in 1955 provided county series for allocating the State totals of interest and dividends in those years.

Estimates for 1929 were prepared by allocating the State totals of private monetary interest and dividends according to the amount of these items reported by residents of each county on their 1934 Federal income tax returns. County estimates for 1940 were derived by interpolation between the 1929 and 1950 figures on the basis of population.

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<sup>7/</sup> The coefficient of correlation between per capita dividends and interest and per capita income was +.92.

### Government Interest

Government interest payments to persons in 1950 and 1955 were allocated to counties in proportion to sales of Series E (plus Series H in 1955) bonds. County bond sales data were supplied by the Treasury Department. Estimates for 1950 were extrapolated to 1929 and to 1940 by population.

There are several sources of weakness in our use of the bond sales data for this purpose. First, they were employed as an allocator of total government interest, including Federal as well as State and local. Also, there is the assumption that a county distribution of bond sales is equivalent to a distribution of the net interest accruing. This latter, in turn, assumes that the net effects of migration and redemptions on the distribution of bondholdings by counties is proportionate to sales, and that the effective interest rate is the same for each county as for the State.

### Imputed Rental Value of Dwellings

Nationally, imputed rents measure the net income accruing to nonfarm residents in their capacity as homeowners. It equals the gross rental value of owner-occupied nonfarm houses less the actual expenses incurred in home ownership. A similar imputation for farm dwellings is included in the estimates of farm income. Imputed rents are included in personal income in order to give comparable treat-

ment to rented and owner-occupied houses. Its inclusion prevents any change in the personal income aggregate from a mere shift in housing practices of renting versus owning.

County estimates of imputed net rental value were prepared by allocating the State totals by the market value of owner-occupied nonfarm homes as computed from Census of Housing reports. Estimated market value was prepared for 1930, 1940, and 1950 by multiplying the number of owner-occupied nonfarm homes in each county by average value. Both numbers of houses and average values were taken from the 15th, 16th, and 17th Census of Housing, with some adjustments in the two series to secure comparability. Figures for 1950 were extended to 1955 by changes in population.

#### Imputed Interest and Monetary Rents

Imputed interest is defined as the excess of property income received by financial intermediaries from funds entrusted to them by persons over property income actually returned in monetary form by these intermediaries to persons. For amplification of this formal definition, reference is made to the State Personal Income bulletin noted earlier. This gives a more detailed description of imputed interest as well as an explanation of the basic rationale for its inclusion in personal income.

Monetary rents (including royalties) are defined on a net basis. Like proprietors' income, they represent the residual difference between gross receipts and expenses (including depreciation). The



net rent of individuals engaged primarily in the real estate business is not included but, along with rentals received by partnerships, is classified in proprietors' income.

In the absence of information reflecting the amounts of imputed interest and monetary rents accruing to residents of the various counties, State totals of these two items were allocated by all other property income flows combined. It should be noted, however, that although imputed interest and monetary rents make up one-fourth of all property income in the Delaware Service Area, they account for less than 5 percent of the total income flow.

#### OTHER COMPONENTS

This final section describes how the estimates for the three remaining components of personal income were made. These include: Other labor income, Transfer payments, and Personal contributions for social insurance. The last is a "negative" component since the contributions made by individuals under social security and similar programs are excluded from personal income, by handling them as a separate deduction item.

#### Other Labor Income

This category consists of supplementary types of labor income paid out or accruing to persons in the current period. These comprise employer contributions to private pension, health, and welfare funds;

compensation for injuries; pay of military reservists; and a number of minor items consisting of directors' fees, jury and witness fees, compensation of prison inmates, and marriage fees of justices of the peace. Other labor income is a relatively small component of personal income, forming only 2 percent of the Delaware Basin Area's total in 1955.

As employer contributions to private pension, health, and welfare funds amount to about three-fourths of the other labor income total, the reliability of the county estimates of this major income share depend very largely on the accuracy of the employer contribution item. These contributions have been measured on a county basis according to the residence of employees for whom they have been made. That is, the geographic breakdown of this item is intended to reflect the amounts contributed by employers on behalf of individuals residing in each of the counties.

While such a concept is clear and meaningful, statistical data by which to implement it are lacking. Given this lack of direct data, employer contributions under private pension and related plans have been estimated in the county series by allocating State totals on the basis of payrolls. Because the ratio of employer contributions to wages and salaries differs widely by industries, this allocation has been carried out in considerable industry detail. A similar procedure was utilized for estimating compensation for injuries and directors' fees.

The remaining items of other labor income together account for less than one-tenth of the total. They have been apportioned to the counties in terms of total population, civilian population, or veteran population, according to the series deemed most appropriate and available.

#### Transfer Payments

Transfer payments consist in general of disbursements made to individuals by government or business for which no services are rendered currently. As noted, major examples of government transfers include unemployment benefits and relief payments. A principal category of business transfers consists of corporate gifts to nonprofit institutions (in personal income nonprofit institutions are considered as persons). Transfers among persons (a gift from one person to another or a contribution from an individual to a church, for example) are excluded as they are canceling when viewed from the standpoint of the economy as a whole.

The estimates of total transfer payments represent the summation of approximately 45 separate series. Some were obtained through a process of detailed data collection. Others were estimated by means of allocators which vary considerably, both in directness and relevancy.

Currently, directly-reported data underlie the estimates of individual items that in combination account for a little more than half of total transfers. In general, these estimates are based on reports of disbursements obtained from the fiscal records of administering government agencies. Moreover, good indirect allocators were available for large segments of the remaining transfers. An example of this is the county distributions of Veterans of World War II which were used to apportion certain of the veterans' payments. Transfer payments for which the statistical basis is weak comprise only a small part of total transfers and an almost negligible fraction of total personal income.

The estimates of transfers for the current period are much more reliable than those of earlier years, when direct data provided an underpinning for only about 5 percent of the transfer component. Partly offsetting this lesser reliability, however, is the fact that in 1929 transfers accounted for less than 2 percent of total income in the Delaware River Basin Area.

The following sections provide a brief summary of the sources of data and methods of estimation underlying the principal transfers or groups of transfers.

Federal Government transfers. Federal Government transfer payments account for two-thirds of total transfers. Two items are singled out for discussion because of the sources of data used.



The others are grouped because of the general similarity of methodology.

Benefit payments under the old-age and survivors insurance program form the major element of Federal transfers. County tabulations of disbursements made under this program in December of 1940, 1950, and 1955 were obtained from the Social Security Administration. These December distributions were used to allocate the State totals of this item to the counties. The program, of course, was not in operation in 1929.

State unemployment insurance benefits, another major component of Federal transfers, were distributed by counties in proportion to wage and salary disbursements reported under the State unemployment insurance program in Connecticut, Delaware, and Pennsylvania. In New Jersey and New York, the county distributions were based on benefit payments or number of claims filed. Benefits paid railroad employees during periods of unemployment were allocated by railroad payrolls.

Federal disbursements to government employees (civilian and military) and to veterans are allocated according to one of three methods. Retirement payments to Federal civilian employees were distributed by counties in accordance with payrolls and employment in 1950 and 1955, and on the basis of population in 1929 and 1940. Transfer payments to military personnel and to veterans were distributed by the estimated county distribution of veterans in 1950 and 1955, and by civilian population in 1929 and 1940. Other Federal transfers

generally were allocated by civilian population, with modifications made in the pattern when data permitted.

State and local government transfers. This group of transfer payments was estimated as the sum of figures for seven separate components. These include direct relief payments, State and local government retirement benefits, cash sickness benefits, public foster home care payments, payments to nonprofit institutions, and State payments to veterans.

By far the largest of the individual programs is direct relief, which constitutes approximately three-fourths of State and local government transfers. County tabulations of disbursements made in December of 1940, 1950, and 1955 for the various relief programs were provided by the Social Security Administration. In addition New York State furnished county figures on relief payments in 1930 (used for 1929). For other States, the relative county distributions reported for 1940 were held constant for 1929.

The other transfer items in the State and local category generally were allocated among counties in accordance with the relative distributions of population -- total, civilian, children, or veterans as appeared appropriate for the item concerned -- or of wages and salaries disbursed in some related activity. An important exception to this generalization is provided by the reported county distributions of State bonuses to veterans of World War II

in Pennsylvania and New York. As this particular component bulked large in the flow of transfers in these two States in one or more years, the accuracy of the estimates of over-all transfers is increased significantly by use of these reported figures.

Business transfers. Business transfer payments represent disbursement (cash or product) to persons by the business system made other than as payments for participation in production. They include corporate gifts to nonprofit institutions, consumer bad debts, cash prizes, unrecovered thefts from business of cash and capital assets, and personal injury payments from business to persons other than employees.

There are little direct data on business transfers even on a national basis. By geographic areas information is totally lacking. Accordingly, the State totals of the various items (statistically weak themselves) were distributed to counties by indirect measures. Corporate gifts to nonprofit institutions were allocated by civilian population; consumer bad debts by sales in retail trade; and the remaining items by total wages and salaries.

#### Personal Contributions for Social Insurance

Contributions made by individuals under the various social insurance programs are excluded from personal income by handling them as an explicit deduction item. Payments by both employees and self-employed are included in the series.

The employee portion covers contributions for old-age and survivors insurance, State unemployment insurance, railroad retirement insurance, cash sickness compensation, and Federal and State and local public employee retirement systems, as well as premium payments for government life insurance. Contributions of the self-employed relate to old-age and survivors insurance.

Personal contributions for social insurance have increased very substantially over the past quarter of a century. In 1929 such contributions in the Delaware area amounted to \$31 million; by 1955 they totaled nearly one billion dollars.

As no direct data on individuals' contributions for social insurance are available, the general procedure was to allocate State totals to the counties on the basis of payrolls in the relevant category of employment. For several of the programs, population or military strength was used.

Measures of the three types of programs in effect in 1929, consisting of Federal civilian retirement systems, State and local retirement systems, and government life insurance, were obtained by allocating the State totals of these programs by the 1930 population. The item in 1929 accounted for only a fraction of one percent of personal income in the Delaware area.

Estimates of the contributions made under the 7 programs in effect during the period 1940-55 were handled in the following manner.



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Old-age and survivors insurance, State unemployment insurance, and cash sickness-compensation funds were allocated to the counties on the basis of total private wage and salary disbursements. State totals of government retirement systems, both Federal and State and local, and of railroad retirement insurance were distributed among the counties by total civilian government wages and salaries and railroad wage and salaries, respectively.

The remaining social insurance programs (government life insurance for the years 1940, 1950 and 1955 and national service life insurance for 1950 and 1955) were allocated to counties in two parts; the civilian components were distributed by civilian population, and the military counterpart of the programs by military strength.

## PERSONAL INCOME PROJECTIONS

National projections of personal income for 1965, 1980, and 2010 were derived from projections of gross national product in those years. In this procedure, the national estimates of personal income for the period since 1929 were divided into three major components — farm, government, and private nonfarm, and each segment was related to the relevant component of gross national product. Relationships between comparable components of GNP and personal income were extended to 1965, 1980, and 2010 on the basis of established trends.

As a check on the figures derived in parts, the national total of personal income was extended on the basis of the historical relationship between this total and gross national product as determined from a graphic regression analysis. The projections so derived coincided closely with those obtained by the more detailed approach.

In development of the projections of personal income for the Area and sub-regions, the national totals for 1965, 1980, and 2010 were first subdivided into components, by industry and type of income. This breakdown of the projected totals was based upon analysis of shifts in the national pattern of income composition since 1929.

The estimates of personal income in the Delaware Area as a whole and in each sub-region in 1929, 1940, 1950, and 1955 were then broken into the same industrial and type of income components as were the national projections of personal income. For the Area and in each sub-region, these components were expressed as a percentage of the corresponding national figures. The percentage shares were analyzed, with those for 1940 generally discounted because of cyclical considerations, and were extended to 1965, 1980, and 2010 in accordance with the historical trends that characterized them over the period back to 1929. It was assumed that beginning around 1980 the historical trend in the rate of growth of each component in the various sub-regions would begin to move gradually toward the national average.

By income components, the shares for the Delaware Area and each sub-region were applied to the appropriate national totals and the results summed to obtain projected total personal income. The total of the projections for the individual sub-regions approximately equaled the overall Area projection.



## GROSS NATIONAL PRODUCT

The development of the National Income and Product Accounts for the United States has been described in detail in a number of volumes published by the Office of Business Economics. For those desiring to review the sources and methods, as well as definitions, underlying these national economic measures, reference should be made to "National Income, 1954 Edition".<sup>8/</sup>

This section treats simply of the projections of gross national product, utilized in the development of Chapter I, and the associated employment figures. The derivation of the employment and population figures is covered in following sections since many of these data were assembled for purposes of this report.

The projections set forth in our report are derived from an assumption of high volume output for the years used as compass points. Since trends in the agricultural, government, and private nonfarm parts of the economy are somewhat different, the gross national product estimate was evaluated by handling each of these segments separately.

Further shrinkage in the proportion of total output and employment in agriculture is assumed in our projections. This is based essentially upon an extension of the Department of Agriculture

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<sup>8/</sup> This volume, a Supplement to OBE's Survey of Current Business, may be obtained from the Government Printing Office, Washington, D.C. or from any of the Field Service Offices of the U.S. Department of Commerce for \$1.50.

projection of the demand for farm products in 1975 and 1980. In the calculation of farm gross national product, it is assumed that production per worker on the farm would increase at the rate of  $2\frac{1}{2}$  percent annually to 1975 and at a 2 percent annual rate thereafter.

Moderate growth was assumed for government employment and product and, since we had no basis for estimating the size of the armed forces in the future, we simply carried in our tables a number approximating the present level. This does not have any appreciable effect upon the projected growth of national output.

Federal civilian government employment was assumed to show a smaller relative rise than total population. The increase for State and local government employment was set at about the same rate as that of the population, although it is recognized that in the past the rate of growth has been somewhat more than this.

Employment in private nonagricultural industries was derived from the evaluation of past trends, the labor force, and the calculations made for agriculture and government. In the projection of nonagricultural gross national product, the past rate of output growth per worker of  $1\frac{1}{2}$  percent per year was accepted as a reasonable approximation.

## EMPLOYMENT

The Census of Population, in the parts dealing with occupations, was the only source available for historical employment data by counties, broken down by major industries and reaching back to 1930. Therefore, all the employment data in this report for 1930, 1940 and April 1950, except the all-industry national totals shown in Table 5 and the 1950 data in Table 6, are taken from the United States Census of Population for those years.

All employment data other than the United States all-industry totals for 1955 and for all subsequent years, are extrapolations based on the 1950 Census of Population. Since they are based on the definition of employment and the industrial classification used in the Census of Population, they are generally different from, and not comparable with, data derived from State Government agencies for the same areas. In addition, they include proprietors of unincorporated business and other self-employed persons, all of whom are excluded from employment statistics of State agencies, and government employees who were also generally excluded prior to 1956. Finally, the data taken from or based on the Census of Population reflect the place of residence of employed persons rather than place of work, which determines the geographic classification of workers included in employment statistics originating in State agencies.

Employment data for the Delaware River Service Area and its sub-regions subsequent to the 1950 Census of Population were obtained by adjusting the 1950 Census tabulation for the change between April 1950 and 1955. The estimation of this change was effected in two steps.

Step one was to raise the data from the April 1950 Census of Population level to the 1950 monthly average employment level as measured by the Census Bureau's Monthly Report on the Labor Force. In the case of the United States employment total on which all of the regional data are based, the upward adjustment amounted to about 3,400,000. Nearly 2.5 million of this adjustment was attributable to the difference between the April 1950 Census of Population employment total and the April 1950 Monthly Report on the Labor Force civilian employment total.

The reader should be alerted to the fact that there is not, therefore, complete comparability between data from the Censuses taken in 1930, 1940 and 1950, and data for subsequent periods. The remainder of the 3.4 million upward adjustment was ascribable to the sharp rise in business activity from April 1950 to the end of the year, which contributed substantially to the higher level of the 1950 monthly averages.

For an individual industry, the national employment total was adjusted upward by applying the percentage increase from April 1950 to the 1950 monthly average registered by the Bureau of Labor Statistics employment covering that same industry. Further slight



adjustments were then made according to the relative size of each industry so that the sum of all the individual-industry employment figures just equaled the 1950 monthly average all-industry employment total computed from the Monthly Report on the Labor Force.

The employment figures for a given industry in each sub-region were adjusted upward to the 1950 monthly average level by giving each area the same percentage of the national total that it had in the April 1950 Census of Population.

Step two was to extrapolate all individual-industry and regional employment data, now on an annual average basis, forward from 1950 to 1955. United States total employment in all industries was the reported figure from the Monthly Report on the Labor Force.

The national total employment for an individual industry was extrapolated forward from 1950 to 1955 according to the percent change registered by that industry as computed from Table 28 of the 1954 edition of the NATIONAL INCOME Supplement<sup>2/</sup> and the corresponding table in the July 1957 Survey of Current Business.

Regional employment data were extrapolated by moving each individual industry ahead according to the change in the corresponding segment of employment in industries covered by State unemployment programs in each area as revealed by comparison of the 1950 and 1955 covered employment statistics. For the New York Metropolitan Area and its Supplement Area, the data from Regional Plan Association Bulletin No. 87 were also used in extrapolating individual industries in those areas from 1950 to 1955.

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<sup>2/</sup> Ibid., p. 202.

### Forward Estimates

Employment projections for the Delaware River Service Area and its sub-regions were derived in three steps. First, the all-industry employment total for the United States was projected ahead. Next, the projected United States all-industry employment total for each year was distributed among the individual major industry groups. Finally, employment projections for each of the sub-regions for each of the major industry groups were derived by projecting each sub-region's share of the national employment total in a given industry.

The projection of the national employment pattern was based upon the projection of the national output and the total employed labor force, with the latter, in turn, being consistent with the population and the assumed labor force participation rates.

Labor force projections of varying sizes for the same future period could be based upon the same population projections if different patterns of labor force participation rates by age and by sex were used. The Census Bureau has published four different projections of labor force participation rates for the years 1960, 1965, 1970 and 1975 (Current Population Reports, Labor Force Series P-50, No. 69).

The differences among these four alternative patterns of labor force participation arise chiefly from the differing assumptions underlying the projections with regard to the outstanding historical trends that have developed since 1920 (the earliest date for which

labor force participation rates are available). Those basic historical trends are: first, the steady decline in the male participation rate, as relatively more young men attend school or college and as relatively more older men retire sooner than formerly was the case; and second, the steady rise in the female participation rate as relatively more women in all age groups above 19 years seek employment outside the home. The rise has been particularly striking in the middle age groups, where the female participation rate nearly doubled between 1920 and 1950.

The difference between the highest and lowest participation rate patterns in the Census report referred to above becomes substantial when projected to 1975, the highest projection averaging over all age groups 4.4 percent larger than the lowest; if these same projections were extended to the year 2010, the difference would be considerably larger. The highest projected rate pattern, Projection II, maintained through 1975 the average annual rate of change in the labor force participation rates that occurred between 1950 and 1955. The lowest projected rate pattern, Projection IV, held all participation rates constant at their 1955 levels through 1975.

For our labor force participation rate projection, we chose a modification of Census Bureau Projection I through 1975. This rate pattern as modified by OBE assumes a continued decline in the male average participation rate from 1955 levels to 1980 largely as a result of lower participation by males of school and college age and

those 55 years old and over; after 1980, the rates for individual age groups remain constant until 2010. Broadly speaking, the rate pattern used assumes the continuation until 1980 of the historical decline in the male participation rate. The resulting average rate in the terminal year is about midway between the highest and the lowest of the Census Bureau's projections for 1975.

Labor force participation by females, according to our assumption, also continues its historic -- i.e., upward -- trend until 1980. Thereafter, however, we have assumed that the factors governing female entry into the labor force would reverse the trend and lower female participation to around 1955 levels by 2010. Among the factors expected to bring about this reversal are the marked rise anticipated in average family income and the growing need for additional education and training that will be required of women seeking jobs outside the home. The resulting average female participation rate in the terminal year of our survey approximated the lowest of the Census Bureau's projections for 1975. The average participation rate for both sexes in 2010, weighted according to the numbers expected in the various age groups, would be about  $2\frac{1}{2}$  percent below the 1955 figure.

We appreciate that the employment total resulting from the application of this labor force participation rate pattern to the population projections and from an allowance for frictional unemployment, might be considered by some to be a conservative figure for the



year 2010. We believe, however, that the figure used is consistent with the much higher level of output per person which we assume will prevail at that time, and with the higher educational and training requirements associated with higher productivity.

#### Employment by Industries

After the United States all-industry employment totals had been projected, these totals were distributed among the major industries shown separately by two different methods used to check each other.

Our first step in distributing the projections of total employment among broad industry groups was to project a pattern of demand for the goods and services produced by them. The population projections coupled with per capita food and nonfood agricultural material requirements yielded the projected demand for the products of agriculture. The government segment was assumed to shrink somewhat as a portion of the total on the ground that defense requirements would not expand so rapidly as civilian activities. Demand for the total private nonfarm output was assumed to absorb the available labor force not utilized in the other two major sources of labor demand.

Based on all the evidence available as to their recent trends, output per person engaged in each of the above broad industry groupings was then projected ahead. Employment projections for these groups were then computed from the estimated demand or output requirements and productivity per person.

A demand pattern was also projected for various nonagricultural commodity producing industries including the five manufacturing industries shown separately because of their importance as large water consumers, and for the service-type industry group. Output per person engaged in production in the various industry groups was projected ahead on the basis of indicated trends. The employment distribution was then derived from the projected output requirements and from output per person engaged. The resulting employment figures are shown in Table 6 .

The employment shifts indicated in the industry figures are the combined result of differential changes in demand for the product and in output per person engaged in the various industries. The slight decline in the share of employment in all manufacturing industries, for example, resulted from projecting an above-average increase in productivity per worker that more than accounted for the projected relative increase in demand for manufactured products.

National employment totals for individual major industries obtained by the foregoing procedure were then compared with those derived from a second method. This was based upon a study of the historical trend of the ratio of employment in each broad industry group to total nonagricultural employment. After consideration of all the information available to us relevant to the growth trends of the various industry groups, this ratio was projected ahead and applied to the projected national total of nonagricultural employment.

In the case of the five manufacturing industries selected for separate projection because they are heavy users of water, the ratio of their employment to total manufacturing employment was projected ahead.

The alternative projections for each industry group obtained from these two methods were then compared and a single figure was determined which best reconciled the advantages of each method.

The employment projections in the aggregate were tested for consistency with the personal income estimates described in an earlier section.

#### Procedures Used for Delaware Area

Employment projections in the Delaware River Service Area were determined by a combination of two procedures. Both were based upon the same underlying method: i.e., the measurement and projection of the differential growth rate of industry in a given area relative to the growth rate of that same industry in the Nation as a whole.

One procedure was to measure and project the differential growth rate of the all-industry total employment in a given area relative to United States total employment. The other procedure was to make separate employment projections for individual industries or industry groups in the area by measuring and projecting their individual differential growth rates within the area relative to the corresponding national industry employment total.

In case the sum of the individual industry estimates obtained by the second procedure differed from the all-industry total obtained from the first procedure, the two sets of estimates were placed side by side and re-examined with the objective of determining how they could be brought into agreement on a single projection or set of projections that would be reasonable from both approaches.

#### POPULATION AND HOUSEHOLDS

The Bureau of the Census is the source of all of the population data used in this study except the projections for the DRSA and its sub-regions. That Bureau has long collected and analyzed data on population, and the Corps of Engineers naturally looked to it for the basic underpinning of the population figures used in the water resource development survey.

The Census Bureau provided the Office of Business Economics four alternative projections of the population, based upon different fertility assumptions. These four series were extensions to the terminal date desired by the Corps of Engineers of those published by the Bureau of the Census through the year 1975. They are designated as projections AA, A, B, and C in the tables given in the Appendix.

The highest of the four projections, the AA series, and the lowest, the C series, cover a wide range. The other two, designated A and B, provide estimates falling between the two extremes.



For the purpose of this survey, the Office of Business Economics decided to use an intermediate projection which did not correspond precisely with any of these four. The Bureau of the Census provided the series actually used (Series "V"). This projected population series is based upon fertility rates which are 5 percent higher in the immediate years ahead than the earlier AA series of the Census. After 1960, the fertility rates are assumed to decline for about three decades, and then to level out at a rate somewhat above the immediate prewar average. Clearly, shifts in fertility rates render hazardous the path of the population forecaster.

The death rate estimates allow for moderate declines through the projection period. Net immigration from abroad was placed at 1.4 million for the period 1955-60, and at 1.2 million for subsequent 5-year periods.

The alternative projections of the total population by age groups and by sex are shown in the accompanying appendix tables.

The population projections of the Delaware River Service Area and of its eight sub-regions are consistent with the employment estimates earlier described in detail.

The percentage of the population employed in each of the sub-regions in 1955 differed from that for the United States. In general, these differences were assumed to be maintained in the projections, since examination of the data for 1930, 1940, 1950, and 1955 showed no definitive trends (relative to the United States) in the ratios of population to employment by sub-regions which could be extrapolated.

The Bureau of the Census provided OBE with all the historical data on households and with the projections of United States totals. The Office of Business Economics made the projections of household numbers in the DRSA and in the eight sub-regions.

As in the case of population, the Census Bureau initially submitted four alternative household projection patterns for the United States based on the AA, A, B, and C population projections. These were extensions to 2010 of the projections shown in the publication "Projections of the Number of Households and Families, 1960 to 1975" (see Current Population Reports, Population Characteristics, Series P-20, No. 69). Subsequently a fifth alternative Series "V" was furnished based on the corresponding Series "V" population projections.

The number of households by definition coincides with the number of occupied dwelling units. The occupants of a dwelling unit may vary from a husband-wife family to a single individual. The method of projecting the number of households for the United States was to apply age-sex-specific household status rates to the projected population classified according to age and sex.

For the DRSA and the sub-regions, the household projections were based on projections of the population and of the average number of persons per household. The basic assumption underlying the regional household projections is that they will register the same change in the average number of persons per household as in the United States. The differences between the average household size in the United States and in each sub-region are assumed to be maintained throughout the projection period.

In the projected national totals of households, little change is indicated in the average number of persons per household in the next decade from the 1955 average of 3.4. In subsequent years, the size of households is affected by the varying fertility assumptions. For series "V" there is only a slight decline in the ratio by 1980, but it moves somewhat lower subsequently. In the alternative population projections, the average number of persons per household in 2010 would be about the same as the "V" series in the case of the "B" and "C" series, but in the "AA" and "A" series would remain at about the present level.

8

APPENDIX

SUPPLEMENTAL STATISTICAL TABLES

AND

EXPLANATORY NOTES ON TABLES

(Including Sources of Data for Tables 1 - 55)

0



Appendix Table 1

UNITED STATES  
GROSS NATIONAL PRODUCT, PERSONAL INCOME, EMPLOYMENT,  
AND POPULATION, 1909-1939

Year	Gross National Product <sup>1/</sup>	Personal Income <sup>2/</sup>	Employment <sup>3/</sup> (Annual av.)	Population <sup>4/</sup> (July 1)
	(Billions of 1957 dollars)		(Millions)	(Millions)
1909	110.7	—	—	90.5
1910	113.1	—	—	92.4
1911	116.6	—	—	93.9
1912	123.2	—	—	95.3
1913	124.5	—	—	97.2
1914	119.2	—	—	99.1
1915	116.9	—	—	100.5
1916	127.7	—	—	102.0
1917	127.8	—	—	103.4
1918	144.2	—	—	104.6
1919	142.9	—	—	105.1
1920	133.8	—	—	106.5
1921	123.5	—	—	108.5
1922	142.0	—	—	110.1
1923	159.5	—	—	112.0
1924	159.4	—	—	114.1
1925	172.7	—	—	115.8
1926	182.5	—	—	117.4
1927	182.2	—	—	119.0
1928	183.4	—	—	120.5
1929	193.9	144.4	47.9	121.9
1930	175.8	135.7	45.7	123.2
1931	162.8	130.1	42.7	124.1
1932	138.1	112.1	39.2	124.9
1933	135.0	109.6	39.0	125.7
1934	149.0	117.0	41.2	126.5
1935	164.1	129.0	42.5	127.4
1936	186.4	145.5	44.7	128.2
1937	197.1	151.2	46.6	129.0
1938	188.6	143.8	44.6	130.0
1939	203.6	154.5	46.1	131.0

NOTE: Data subsequent to 1939 have been presented in Table 5

Footnotes to Appendix Table 1.

1/ Estimates for the years prior to 1929 are derived from different sources and by different methods from regularly published series. A complete statement of the methodology underlying the pre-1929 estimates will be presented in a forthcoming publication of the Office of Business Economics.

2/ Personal Income: Continental United States. Source: U. S. Department of Commerce, Office of Business Economics. Totals are the annual series on State personal income translated to a constant 1957 dollar basis by the deflator implicit in the Department of Commerce estimates of constant-dollar personal consumption expenditures.

3/ Employment: Source: Beginning 1940, U. S. Department of Commerce, Bureau of the Census. Years prior to 1940 were constructed by U. S. Department of Labor, Bureau of Labor Statistics, to provide a historical series comparable in concept to the estimates issued by the Bureau of the Census beginning that year. Employment as tabulated here represents employed civilians and members of the armed forces.

4/ Population: Total United States (including armed forces overseas). Source: U. S. Department of Commerce, Bureau of the Census.

Appendix Table 2

## UNITED STATES

## MAJOR COMPONENTS OF GROSS NATIONAL PRODUCT, 1909-1957

Year	Gross National Product <u>1/</u>	Farm	Government	Private Nonfarm
(Billions of 1957 dollars)				
1909	110.7	13.3	5.8	91.6
1910	113.1	13.6	6.1	93.4
1911	116.6	12.7	6.3	97.6
1912	123.2	15.2	6.5	101.5
1913	124.5	12.8	6.8	104.9
1914	119.2	14.0	7.1	98.1
1915	116.9	15.9	7.4	93.6
1916	127.7	13.6	7.6	106.5
1917	127.8	15.1	9.8	102.9
1918	144.2	13.8	19.5	110.9
1919	142.9	14.5	13.5	114.9
1920	133.8	14.6	10.0	109.2
1921	123.5	13.0	9.9	100.6
1922	142.0	14.0	9.6	118.4
1923	159.5	15.0	9.8	134.7
1924	159.4	14.2	10.2	135.0
1925	172.7	15.8	10.6	146.3
1926	182.5	14.9	10.9	156.7
1927	182.2	15.8	11.3	155.1
1928	183.4	14.9	11.5	157.0
1929	193.9	15.4	11.9	166.6
1930	175.8	14.3	12.5	149.0
1931	162.8	16.6	12.7	133.5
1932	138.1	15.6	12.4	110.1
1933	135.0	15.2	13.6	106.2
1934	149.0	12.7	16.0	120.3
1935	164.1	15.5	17.1	131.5
1936	186.4	13.0	20.2	153.2
1937	197.1	16.9	18.8	161.4
1938	188.6	16.7	20.5	151.4
1939	203.6	16.6	20.6	166.4

Appendix  
Table 2 (Cont'd.)

UNITED STATES

MAJOR COMPONENTS OF GROSS NATIONAL PRODUCT, 1909-1958 (Continued)

Year	Gross National Product <sup>1/</sup>	Farm	Government	Private Nonfarm
(Billions of 1957 dollars)				
1940	221.9	16.2	20.6	185.1
1941	258.2	17.4	25.7	215.1
1942	297.9	18.9	37.4	241.6
1943	327.4	17.4	58.5	251.5
1944	351.5	17.8	67.6	266.1
1945	345.5	16.8	66.3	262.4
1946	305.4	17.0	34.8	253.6
1947	305.0	15.7	26.5	262.8
1948	316.6	17.8	26.6	272.2
1949	316.5	17.0	27.8	271.7
1950	343.4	17.9	28.8	296.7
1951	370.8	16.7	35.8	318.3
1952	384.2	17.4	38.6	328.2
1953	401.4	18.0	38.2	345.2
1954	393.9	18.8	37.6	337.5
1955	425.5	19.8	37.5	368.2
1956	435.3	19.4	38.4	377.5
1957	442.5	19.1	39.0	384.4
1958	431.8	20.1	39.3	372.4

<sup>1/</sup> See Appendix Table 1.



Appendix Table 3

## UNITED STATES

## PROJECTION V OF THE TOTAL POPULATION BY BROAD AGE GROUPS

AGE	1955	1965	1980	2010
(Millions)				
<u>BOTH SEXES</u>				
ALL AGES.....	165	195	248	370
Under 15 years.....	49	61	75	100
15-under 40 years.....	58	65	93	139
40-under 65 years.....	45	51	55	98
65 years and over.....	14	18	24	33
<u>MALES</u>				
ALL AGES.....	82	96	122	184
Under 15 years.....	25	31	38	51
15-under 40 years.....	29	33	47	70
40-under 65 years.....	22	25	26	49
65 years and over.....	7	8	10	14
<u>FEMALES</u>				
ALL AGES.....	83	99	125	186
Under 15 years.....	24	30	37	49
15-under 40 years.....	29	32	46	68
40-under 65 years.....	23	27	28	50
65 years and over.....	7	10	14	19

Source: U. S. Department of Commerce, Bureau of the Census and Office of Business Economics. This projection, Census Series "V", was used in the body of the report. It assumes that the birth rate for the next few years will be about 5 percent above the level in 1954-55 (AA) and then decline to the 1949-51 level by 1970-75. A more gradual decline to the (1942-44) average rate by 1990 is assumed and this rate is held constant thereafter.

Appendix Table 4

## UNITED STATES

## PROJECTION AA OF POPULATION BY BROAD AGE GROUPS

AGE	1955	1965	1980	2010
(Millions)				
<u>BOTH SEXES</u>				
ALL AGES.....	165	193	250	441
Under 15 years.....	49	60	81	144
15-under 40 years.....	58	65	92	169
40-under 65 years.....	45	51	54	97
65 years and over.....	14	17	23	31
<u>MALES</u>				
ALL AGES.....	82	96	124	220
Under 15 years.....	25	31	42	70
15-under 40 years.....	29	33	47	83
40-under 65 years.....	22	25	26	49
65 years and over.....	6	7	9	13
<u>FEMALES</u>				
ALL AGES.....	83	98	127	221
Under 15 years.....	24	29	40	74
15-under 40 years.....	29	32	46	86
40-under 65 years.....	23	27	28	48
65 years and over.....	7	10	13	18

NOTE: These figures represent extensions of the AA series of projections for 1975 published in Bureau of Census Series P-25, No. 123. Projections assume that the AA (1954-55) fertility level assumed for the 1970-75 period declines gradually to the A (1950-53) level by 2005-2010. Projected mortality rates allow for declines in mortality. Net immigration from abroad assumed to number 1.2 million for each 5-year period.

Appendix Table 5

## UNITED STATES

## PROJECTION A OF POPULATION BY BROAD AGE GROUPS

AGE	1955	1965	1980	2010
(Millions)				
<u>BOTH SEXES</u>				
ALL AGES.....	165	190	241	407
Under 15 years.....	49	57	75	130
15-under 40 years.....	58	65	89	153
40-under 65 years.....	45	51	54	92
65 years and over.....	14	17	23	31
<u>MALES</u>				
ALL AGES.....	82	94	119	203
Under 15 years.....	25	29	38	67
15-under 40 years.....	29	33	45	78
40-under 65 years.....	22	25	26	45
65 years and over.....	6	7	10	13
<u>FEMALES</u>				
ALL AGES.....	83	96	122	204
Under 15 years.....	24	28	37	63
15-under 40 years.....	29	32	44	75
40-under 65 years.....	23	26	28	47
65 years and over.....	7	10	13	18

NOTE: These figures represent extensions of the A series of projections for 1975 published in Bureau of Census Series P-25, No. 123. Projections assume that the A (1950-53) fertility level assumed for the 1970-75 period remains constant throughout the projection period. Projected mortality rates allow for declines in mortality. Net immigration from abroad assumed to number 1.2 million for each 5-year period.

Appendix Table 6

UNITED STATES  
PROJECTION B OF POPULATION BY BROAD AGE GROUPS

AGE	1955	1965	1980	2010
(Millions)				
<u>BOTH SEXES</u>				
ALL AGES.....	165	190	226	307
Under 15 years.....	49	57	60	74
15-under 40 years.....	58	65	89	111
40-under 65 years.....	45	51	54	91
65 years and over.....	14	17	23	31
<u>MALES</u>				
ALL AGES.....	82	94	111	152
Under 15 years.....	25	29	31	38
15-under 40 years.....	29	32	45	56
40-under 65 years.....	22	25	26	45
65 years and over.....	6	8	9	13
<u>FEMALES</u>				
ALL AGES.....	83	96	115	155
Under 15 years.....	24	28	30	36
15-under 40 years.....	29	32	44	55
40-under 65 years.....	23	27	28	46
65 years and over.....	7	10	13	18

NOTE: These figures represent extensions of the B series of projections for 1975 published in Bureau of Census Series P-25, No. 123. Projections assume that the C (1940-42) fertility level assumed for the 1970-75 period remains constant throughout the rest of the projection period. Projected mortality rates allow for declines in mortality. Net immigration from abroad assumed to number 1.2 million for each 5-year period.



Appendix Table 7

UNITED STATES  
PROJECTION C OF POPULATION BY BROAD AGE GROUPS

AGE	1955	1965	1980	2010
(Millions)				
<u>BOTH SEXES</u>				
ALL AGES.....	165	186	218	289
Under 15 years.....	49	53	56	69
15-under 40 years.....	58	65	85	104
40-under 65 years.....	45	51	54	85
65 years and over.....	14	17	23	31
<u>MALES</u>				
ALL AGES.....	82	92	107	143
Under 15 years.....	25	27	29	35
15-under 40 years.....	29	32	43	53
40-under 65 years.....	22	25	26	42
65 years and over.....	6	8	9	13
<u>FEMALES</u>				
ALL AGES.....	83	94	111	146
Under 15 years.....	24	26	28	34
15-under 40 years.....	29	32	42	51
40-under 65 years.....	23	27	28	43
65 years and over.....	7	10	13	18

NOTE: These figures represent extensions of the C series of projections for 1975 published in Bureau of Census Series P-25, No. 123. Projections assume that the C (1940-42) fertility level assumed for the 1970-75 period remains constant throughout the rest of the projection period. Projected mortality rates allow for declines in mortality. Net immigration from abroad assumed to number 1.2 million for each 5-year period.

Appendix Table 8

## DELAWARE RIVER SERVICE AREA

ESTIMATES OF POPULATION BY COUNTIES: JULY 1, 1955 AND 1956  
(Thousands)

	1950	1955	1956
Delaware River Service Area, total..	19,811	21,589	21,877
1. New York City Metropolitan.....	12,912	13,851	14,049
New York 1/.....	9,556	10,168	10,282
New York City (5 boroughs).....	7,892	7,820	7,806
Nassau.....	673	1,053	1,125
Suffolk.....	276	466	502
Rockland.....	89	108	111
Westchester.....	626	721	739
New Jersey.....	3,356	3,686	3,766
Bergen.....	539	690	716
Passaic.....	337	369	382
Essex.....	906	905	913
Hudson.....	647	607	599
Union.....	398	452	460
Middlesex.....	265	348	363
Morris.....	164	204	218
Somerset.....	99	111	116
2. New York City Supplement.....	1,039	1,221	1,227
New York.....	309	357	356
Putnam.....	20	28	29
Orange.....	152	169	167
Dutchess.....	137	160	161
New Jersey.....	225	269	281
Monmouth.....	225	269	281
Connecticut.....	504	595	590
Fairfield.....	504	595	590
3. Bethlehem-Allentown-Reading 2/.....	736	798	799
Pennsylvania.....	639	696	694
Lehigh.....	198	220	222
Northampton.....	185	199	196
Berks.....	256	277	276
New Jersey.....	97	102	105
Warren.....	54	56	58
Hunterdon.....	43	46	47

Appendix Table 8  
(Continued)

DELAWARE RIVER SERVICE AREA

ESTIMATES OF POPULATION BY COUNTIES: JULY 1, 1955 AND 1956

(Thousands)

	1950	1955	1956
4. Trenton Metropolitan.....	230	250	253
New Jersey.....	230	250	253
Mercer.....	230	250	253
5. Philadelphia Metropolitan.....	3,671	4,121	4,157
Pennsylvania.....	3,143	3,508	3,512
Bucks.....	145	258	285
Montgomery.....	353	454	471
Chester.....	159	188	197
Delaware.....	414	511	495
Philadelphia.....	2,072	2,097	2,064
New Jersey.....	528	613	645
Camden.....	301	328	352
Gloucester.....	92	108	114
Burlington.....	136	177	179
6. Wilmington Metropolitan.....	268	329	346
New Jersey.....	50	52	55
Salem.....	50	52	55
Delaware.....	219	277	291
New Castle.....	219	277	291
7. Upper Basin.....	541	551	551
New York.....	178	186	193
Delaware.....	44	42	41
Sullivan.....	41	42	40
Ulster.....	93	102	112
Pennsylvania.....	329	327	318
Wayne.....	28	29	27
Pike.....	8	10	10
Monroe.....	34	39	37
Carbon.....	58	56	56
Schuylkill.....	201	193	187
New Jersey.....	34	38	40
Sussex.....	34	38	40

Appendix Table 8  
(Continued)

DELAWARE RIVER SERVICE AREA

ESTIMATES OF POPULATION BY COUNTIES: JULY 1, 1955 AND 1956

(Thousands)

	1950	1955	1956
8. Southern Basin and Coastal.....	414	469	494
New Jersey.....	315	349	368
Ocean.....	57	71	78
Atlantic.....	132	137	146
Cape May.....	37	43	45
Cumberland.....	89	98	99
Delaware.....	99	120	127
Kent.....	38	55	61
Sussex.....	61	65	66

1/ Special census figures as of April 1, 1957 for the New York parts of the New York City Standard Metropolitan Area are as follows: New York City, 7,795,471; Nassau Co., 1,179,091 (census figure for Long Beach City extrapolated from March 1956); Suffolk Co., 528,736; Rockland Co., 113,783; and Westchester Co., 752,406.

2/ Equivalent to Allentown-Bethlehem-Easton Standard Metropolitan Area, Reading Standard Metropolitan Area, and Hunterdon County.

NOTE: Figures relate to the "resident" population, i.e., the civilian population plus members of the Armed Forces stationed in the area.



Appendix Table 9

DELAWARE RIVER SERVICE AREA  
NUMBER OF HOUSEHOLDS BY COUNTIES  
(Thousands)

	April 1, 1930	April 1, 1940	April 1, 1950
Delaware River Service Area, total..	4,076	4,724	5,711
1. New York City Metropolitan.....	2,668	3,146	3,777
New York.....	1,973	2,368	2,818
New York City (5 boroughs).....	1,723	2,048	2,360
Nassau.....	75	108	189
Suffolk.....	38	48	72
Rockland.....	14	16	22
Westchester.....	123	148	176
New Jersey.....	696	779	959
Bergen.....	91	110	157
Passaic.....	75	84	101
Essex.....	203	222	257
Hudson.....	165	173	188
Union.....	73	85	112
Middlesex.....	48	54	73
Morris.....	26	32	44
Somerset.....	15	18	26
2. New York City Supplement.....	195	224	292
New York.....	61	70	84
Putnam.....	3	4	6
Orange.....	33	37	43
Dutchess.....	25	29	35
New Jersey.....	39	44	64
Monmouth.....	39	44	64
Connecticut.....	94	110	144
Fairfield.....	94	110	144
3. Bethlehem-Allentown-Reading.....	161	177	209
Pennsylvania.....	139	153	180
Lehigh.....	42	46	56
Northampton.....	40	43	51
Berks.....	57	64	73
New Jersey.....	22	24	29
Warren.....	13	14	16
Hunterdon.....	9	10	13
4. Trenton Metropolitan.....	43	49	59
New Jersey.....	43	49	59
Mercer.....	43	49	59

Appendix Table 9  
(Continued)

DELAWARE RIVER SERVICE AREA  
NUMBER OF HOUSEHOLDS BY COUNTIES  
(Thousands)

	April 1, 1930	April 1, 1940	April 1, 1950
5. Philadelphia Metropolitan.....	742	831	1,019
Pennsylvania.....	640	719	875
Bucks.....	24	28	41
Montgomery.....	61	71	94
Chester.....	30	33	40
Delaware.....	67	80	114
Philadelphia.....	459	507	586
New Jersey.....	102	112	144
Camden.....	61	67	85
Gloucester.....	18	19	26
Burlington.....	23	25	33
6. Wilmington Metropolitan.....	47	57	75
New Jersey.....	9	11	14
Salem.....	9	11	14
Delaware.....	38	46	61
New Castle.....	38	46	61
7. Upper Basin .....	131	142	155
New York.....	43	47	53
Delaware.....	11	11	13
Sullivan.....	10	11	12
Ulster.....	22	25	28
Pennsylvania.....	81	87	92
Wayne.....	7	8	8
Pike.....	2	2	3
Monroe.....	7	8	10
Carbon.....	14	15	16
Schuylkill.....	51	54	55
New Jersey.....	7	8	10
Sussex.....	7	8	10
8. Southern Basin and Coastal.....	89	99	125
New Jersey.....	68	74	95
Ocean.....	9	11	18
Atlantic.....	32	35	40
Cape May.....	8	9	12
Cumberland.....	18	20	26
Delaware.....	21	25	30
Kent.....	9	10	11
Sussex.....	12	15	18

Source: Bureau of the Census.

## EXPLANATORY NOTES TO THE TABLES

### General note to all tables:

Data may not add to totals due to rounding.

### Table 1

#### Gross National Product and Personal Income -

Source: U. S. Department of Commerce, Office of Business Economics. Personal income is for continental United States, and per-capita figures are computed using July 1 estimates of population residing in continental United States excluding armed forces overseas.

#### Population -

Source: U. S. Department of Commerce, Bureau of the Census. Projections based on Census Bureau's population projection, Series "V". See Chapter V, Sources and Methods used in Preparing Basic Measures, section on population.

#### Households -

Source: U. S. Department of Commerce, Bureau of the Census. 1955 data are for April 1. Projections are based on the Census Bureau's Series "V" population projection and are explained in Chapter V, Sources and Methods used in Preparing Basic Measures, section on households.

#### Employment -

Source: U. S. Department of Commerce. Historical data: Bureau of the Census. Projections: Office of Business Economics. Data reflect total employment including armed forces overseas.

### Table 2

#### Personal Income -

Source: U. S. Department of Commerce, Office of Business Economics. See Chapter V, Sources and Methods used in Preparing Basic Measures, section on personal income.

**Explanatory Notes To The Tables (Continued)**

**Table 2 - Continued**

**Population -**

**Source:** U. S. Department of Commerce. 1955 data, from the Bureau of the Census, are for resident population, excluding armed forces overseas. Projections, by the Office of Business Economics, represent total population as no attempt was made to estimate armed forces overseas.

**Households -**

**Source:** U. S. Department of Commerce. 1955 figures, from the Bureau of the Census, are for April 1. Projections: Office of Business Economics.

**Employment -**

**Source:** U. S. Department of Commerce, Office of Business Economics.

**Petroleum and Coal Products, and Paper and Allied Products**

Regional data for these industries in 1955 are partly estimates based chiefly on data for metropolitan areas; data for counties outside of metropolitan areas were generally not available.

**Armed Forces Overseas**

These are excluded from the 1955 figures. In the projections, however, no attempt was made to estimate the size of armed forces overseas; hence they are implicitly included. Whenever armed forces overseas are included in the total, then they are also included in the noncommodity producing industry group which comprises government employees, trade, transportation, public utilities and all other service-type industries.

**Table 3**

**Source:** U. S. Department of Commerce, Office of Business Economics.

**Table 4**

**Population -**

**Source:** U. S. Department of Commerce. 1955 data, from the Bureau of the Census, are for resident population (excluding armed forces overseas). Projections, by the Office of Business Economics, represent total population as no attempt was made to estimate armed forces overseas.



Explanatory Notes To The Tables (Continued)

Table 4 - Continued

Employment -

Source: U. S. Department of Commerce, Office of Business Economics. (See note on employment for Table 2 relative to exclusion of armed forces overseas.)

Table 5

Gross National Product -

Source: U. S. Department of Commerce, Office of Business Economics.

Total Personal Income -

Source: U. S. Department of Commerce, Office of Business Economics.

Employment -

Source: Years 1940 to date, U. S. Department of Commerce, Bureau of the Census. Years prior to 1940 constructed by Department of Labor, Bureau of Labor Statistics, to provide a comparable series for earlier years. These employment data follow the concepts and definitions of the Monthly Report on the Labor Force and represent civilian employment and members of the armed forces wherever stationed.

Population -

Source: U. S. Department of Commerce, Bureau of the Census. Population figures are as of July 1 of each year; they include resident population of continental United States and, beginning in 1940, armed forces overseas.

Table 6

Source: U. S. Department of Commerce, Office of Business Economics. See Chapter V, Sources and Methods used in Preparing Basic Measures, section on employment. The 1950 employment data in Table 6 are monthly averages for that year on the Monthly Report on the Labor Force basis, not the April 1950 Census of Population. Data in this table reflect total employment including armed forces overseas.

Tables 7 through 32

Source: See sections on personal income in Chapter V.

**Explanatory Notes To The Tables (Continued)**

**Table 33**

Source: U. S. Department of Commerce, Bureau of the Census. Decennial data are for census enumeration dates, estimates for 1955 and 1956 are for July 1. The 1870 figure is an adjusted census estimate.

**Tables 34 and 35**

Source: U. S. Department of Commerce. Data for April 1930, 1940 and 1950 are from the Census of Population. Data for 1955 are estimates by the Office of Business Economics. They and also the projections were derived as explained in Chapter V, Sources and Methods used in Preparing the Basic Measures, section on employment.

**Tables 36 and 37**

Source: U. S. Department of Commerce. Data for April 1930, 1940 and 1950 are from the Census of Population for those years. Figures for 1955 and the projections were prepared by the Office of Business Economics. For their derivation, see Chapter V, Sources and Methods used in Preparing Basic Measures, section on employment.

**Table 38**

Source: U. S. Department of Commerce, Bureau of the Census. Decennial data are for census enumeration dates. Estimates for 1955 and 1956 are for July 1.

**Table 39**

Source: U. S. Department of Commerce, Bureau of the Census.

**Table 40**

Source: U. S. Department of Commerce, Office of Business Economics. Data represent total population as no attempt was made to estimate armed forces overseas.

Explanatory Notes To The Tables (Continued)

Tables 41 and 42

Source: U. S. Department of Commerce, Bureau of the Census.

Table 43

Source: U. S. Department of Commerce, Bureau of the Census. All data for 1930, 1940 and 1950 and the United States data for 1955 are for April; regional data for 1955 are for July 1.

Table 44

Source: U. S. Department of Commerce. Projections of national totals were made by the Bureau of the Census; regional projections were made by the Office of Business Economics.

Table 45

Source: U. S. Department of Commerce. United States data for 1900 and 1930 and Delaware River Service Area data for 1930 are from the Census of Population for those years. The 1955 data exclude armed forces overseas. The 1955 United States all-industry total is from the Census Bureau's Monthly Report on the Labor Force, all other 1955 data are estimates by the Office of Business Economics developed according to the procedure outlined in Chapter V, Sources and Methods used in Preparing the Basic Measures, section on employment. The Delaware River Service Area data for 1900, which are estimates by the Office of Business Economics, include official data from the 1900 Census of Population for the States of Delaware and New Jersey, for Bridgeport, Connecticut and for all of the cities in the DRSA segments of New York and Pennsylvania that were reported separately, plus estimates for the largely rural areas outside those cities.

Explanatory Notes To The Tables (Continued)

Table 46

Source: U. S. Department of Commerce. 1930 data, Bureau of the Census. 1955 data, Office of Business Economics; their derivation is explained in Chapter V, Sources and Methods used in Preparing the Basic Measures, section on employment.

Table 47

Source: U. S. Department of Commerce, Office of Business Economics. Data computed from the figures in Tables 48 and 51 after adjustment to show agriculture separately from other commodity producing industries.

Table 48

Source: U. S. Census of Population, 1930. Data for the petroleum and coal products industry were not available. Data for the primary metal industries are estimates based on the industrial classification used in the 1930 Census of Population which was considerably different from the industrial classification in the later censuses.

No adjustment has been made in the 1930 Census data to make them strictly comparable with the 1940 Census. For the United States total, the Bureau of the Census estimated that a reduction in the 1930 estimate by 3.8 million is indicated for adjustment to the procedure used in the 1940 Census. This adjustment has not been used because no comparable adjustments are available except for the United States total.

Table 49

Source: U. S. Census of Population, 1940.



Explanatory Notes To The Tables (Continued)

Table 50

Source: U. S. Census of Population, 1950. The numbers of armed forces personnel stationed in the various areas have been added to the census data covering civilian employment; they are included in the all-industry totals and in the noncommodity producing industry group which also includes other government employees, trade, transportation, public utilities and all other service-type industry employment.

Regional data for the petroleum and coal products and paper and allied products industries are in part estimates based on metropolitan area data with official data for the non-metropolitan areas generally not available.

Table 51

Source: U. S. Department of Commerce, Office of Business Economics. For an explanation of the derivation of these data, see Chapter V, Sources and Methods used in Preparing Basic Measures.

Table 52

Source: U. S. Department of Commerce, Office of Business Economics. Data in this table calculated from the data in Table 38.

Table 53

Source: U. S. Department of Commerce, Office of Business Economics. Data in this table calculated from the data in Table 38.

Table 54

Source: Delaware River Port Authority, Port Development Department.

Table 55

The figures shown for total imports and total exports of the United States exclude trade through Great Lake ports which include some oceanborne commerce.

Source: Department of the Army, Corps of Engineers, Annual Report of Chief of Engineers; Bureau of the Census, FT 985, Annual Reviews of Waterborne Commerce of the United States, and Foreign Commerce and Navigation.